POST OFFICE

tele communications

JOURNAL

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Post Office Telecommunications Journal

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Vol. 11 *Spring,* 1959 *No.* 2

Radio and the Universe

WE PUBLISH IN THIS ISSUE AN ARTICLE UNUSUAL for the *Journal:* "The New Science of Radio Astronomy", written at our request by Dr. H. P. Palmer, of Manchester University's Experimental Station at Jodrell Bank. The use of radio for scanning the distant universe takes us far beyond the normal mundane uses of long-distance telegraphy and telephony, for exchanging messages between the shore and ships at sea, for sound and vision broadcasting and for such controls as road service, as exemplified by our Winter issue article on the Automobile Association's network.

But in his Reith Lectures last Autumn, Professor Lovell, Director of Jodrell Bank, recording that one of his young men had studied the moon by radio, added that the results implied that the moon could be used as a space relay for long-distance radio communications to overcome the severe hindrances caused by fade-outs. During one lecture he broadcast his own "Hello!" to the moon and the responsive echo. As we go to press the newspapers report a possibly record sunspot that may cause magnetic storms and cause radio engineers to hope that the implication may some day prove practicable.

Radio communication has developed so rapidly during the past few years that it is well for all engaged in telecommunications to study its various and astonishing possibilities. Dr. Palmer's article may take us into a wider sphere but, with an artificial planet in orbit round the sun, the magnitude of the Universe is lessening in our minds, and we may yet call on another new world to help towards solving the problems of the old.

The Queen dials the first STD call

"I AM ALWAYS INTERESTED IN ANY DEVELOPMENT which brings my people closer together." So said Her Majesty the Queen when inaugurating Subscriber Trunk Dialling at Bristol on December 5 last. "In a few minutes Bristol subscribers will be able to make trunk calls by merely dialling the right number, up to a distance of 300 miles."

Her Majesty had herself dialled the first call, to the Lord Provost of Edinburgh—300 miles away, the greatest distance over which a subscriber dialled trunk call could be made from Bristol. The call lasted for 2 minutes 5 seconds; it would have cost 1s. 10d. A few minutes earlier, under the old system, it would have cost 3s. 9d.

After making the call the Queen threw a switch and so put 18,000 telephones connected to Bristol Central Exchange on the new system.

The new system is working very well and Bristol subscribers are making full use of the dialling facility. They are dialling 5,000 trunk calls a day and only a small porportion of calls which could be

and tours Burnham Radio Station

dialled are coming to the operator for assistance. It is difficult to judge the effect on traffic because this has been affected by pre-Christmas pressure and the holiday season, but first indications were that trunk calls to the exchanges which can be dialled increased by about 30 per cent.

STD will be introduced at Bodmin this summer and at Evesham later in the year. Forty-three more places are scheduled for GRACE by the end of 1960, and more than 100 towns should have it by the end of 1961.

Before making the first call Her Majesty and Prince Philip had toured the Exchange, showing immense interest in all they saw. The Queen, at her own request, was shown how a 999 call is operated, and an operator, putting a call through to Cheltenham, explained the maze of wires and sockets on her switchboard. Her Majesty and the Prince, with the Postmaster General, had also toured the exhibition which had been opened to show Bristol subscribers exactly what STD means, how it works and how to use it.

The Queen made her call on one of the new "700 Type" telephone instruments. She had personally chosen blue from among the six colours in which they will be available to the public this spring. A commemorative plaque was later fixed to the new instrument, which has been presented to the Queen for her personal use.

The Bristol ceremony was held during the afternoon of December 5, after Her Majesty had opened the new Engineering Wing at Bristol University.

Visit to Burnham

During the morning the Queen had toured Burnham Coast Radio Station—Prince Philip, having been delayed in Germany by fog, could not join Her Majesty until after lunch.

At Burnham the Postmaster General and Mr. L. G. Froud, Officer-in-Charge, showed the Queen how Burnham maintains world-wide radio connection with ships at sea and learned something of the "Medico" and Distress services. Her Majesty exchanged radiotelegraph greetings with the Master of the *Empress of Britain* which was in mid-Atlantic on her 43rd voyage since the Queen launched her some years ago.

"I know the Morse code," said the Queen as she watched the operators, "but I can't send as fast as your people."

Her Majesty told the Postmaster General that this was the first time she had personally dialled a call, and it is certainly the first time a reigning monarch has been photographed using a telephone.

Ilfracombe Coast Radio Station Opened

During her tour of the south-west, the Queen was shown a photograph of the new Post Office Coast Radio Station at Ilfracombe.

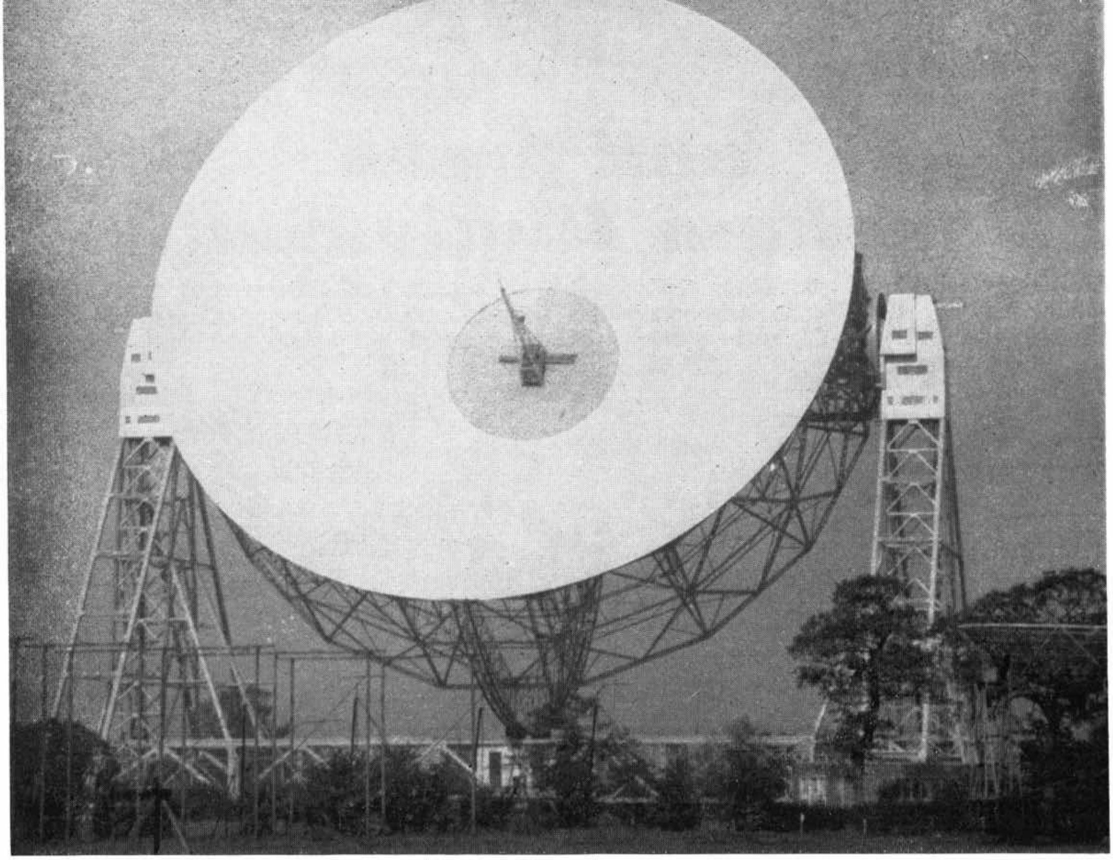
Mr. T. A. Davies, Inspector of Wireless Telegraphy (on behalf of the Assistant Postmaster General, who was detained at the house) opened the new station on January 29, exchanging messages with Bristol Pilot Boat, then in Barry Roads.

The new station has taken over the short-distance radiotelegraph and telephone services from the temporary station opened three years ago in the local Head Post Office, and from Burnham. The site enables better service for ships in the Bristol Channel area. About 75-100 ships may be in these waters any day and some 12,000 ocean-going ships arrive in the Channel ports every year.

In addition to the normal ship-shore services Ilfracombe will provide Distress and "Medico" services, broadcast gale and navigational warnings and weather bulletins, and direction-finding services when the necessary aerials have been erected.

The new VHF ship-shore telephone service from **Niton, Isle of Wight**—third in the chain of such Post Office stations—was opened on January 21. It provides similar facilities to those in the Firth of Clyde and at North Foreland. Equipped ships in the approaches to Southampton and the English Channel within about 50 miles of St. Catherine's Point, Isle of Wight, can use these facilities.

Further VHF services are planned from the stations at Land's End and Humber (Mablethorpe).



Radio Telescope at Jodrell Bank

The New Science of Radio Astronomy

H. P. Palmer, B.A., D.Phil., F.R.A.S., F.R.Met.S.

An ideal astronomical observatory would be outside the Earth's atmosphere, perhaps on the Moon, or on an artificial satellite vehicle. There an observer could study the Sun, planets, stars and galaxies using the complete spectrum of electromagnetic radiation which they emit. The Earth's atmosphere absorbs or reflects much of this radiation, and for the present, astronomical observations (apart from rocket experiments) are restricted to the two regions of the spectrum which reach the surface without appreciable absorption. Fig. 1 shows that one of the transparent regions admits visible light, while the other falls in the radio region of the spectrum, covering the wide range of wavelengths from 1 cm. to approximately 20 metres. The edges of these "windows" are not perfectly sharp, and the boundary defined by the ionosphere at metre wavelengths is markedly variable with time of day, year and sun spot cycle.

The exploration of the extra-terrestrial radiation at radio wavelengths has become possible in the last fifteen years, with the development of sensitive VHF and microwave receivers, and the construction of large aerials. This work has developed rapidly, and has split into three reasonably distinct series of observations, of the Sun, of the Moon and

planets, and of the galactic and extra-galactic, radio sources.

The Sun is the most intense source of radio waves in the sky. At centimetre wavelengths the radiation is steady, and its intensity is the same as one expects from an object with a temperature of the Sun's surface (6,000 K). At longer wavelengths the intensity may vary over a wide range, and intense bursts are associated with sunspots.

Like the Sun, the Moon and nearer planets emit radiation at centimetre wavelengths with smaller intensities, corresponding to their lower temperatures. Jupiter also gives an intense but fluctuating radio emission at a wavelength of about 15 metres, but its precise origin has yet to be discovered.

The "signal" observed in these measurements is "white random noise", the total of innumerable radio pulses from the collisions and deflections of an enormous host of electrons. Such noise can be observed on an oscilloscope, or heard with a loudspeaker. In fact it is often audible as a continuous rough hiss when the volume is turned up on a TV or VHF receiver. An observation of the emission from Venus, for example, shows as a small increase in the noise level of a sensitive receiver, as the aerial is directed towards the planet. There is *no* evidence at all for any Venusian morse code, Flying Saucer radio traffic, or any other intelligence in the radiation.

An important branch of radio astronomy is the study of the radiation coming from the Milky Way and other galaxies like it which are scattered across the Universe. A photograph of a relatively close galaxy is shown in Fig. 2. This immense disc-like structure is about 10 million light years distant (one light year is six million million miles), and it has a diameter of 100,000 light years. The spiral arms of the galaxy contain billions of stars embedded in interstellar clouds of dust particles, and glowing clouds of very rarefied hydrogen gas.

All the 6,000 stars visible to the naked eye belong to the galaxy of which the Sun is an unimportant member. The galactic disc is outlined by the myriads of distant stars and gas clouds which make up the Milky Way.

The radio waves from the galaxy are concentrated into a band along the Milky Way, and they make up the major part of the radio emission reaching the Earth. Superimposed on this galactic background are a large number of localised concentrations of radio emission, which are referred to as "discrete sources". The intense sources give impressive records when observed with a large aerial, and Fig. 3 shows a set of observations made recently at a wavelength of 1.89 metres, using the two large radio telescopes at Jodrell Bank. Throughout this observation the aerials were fixed, with their beams aligned in the same direction. The noise output of the receivers connected to each aerial is recorded on the upper and lower trace of

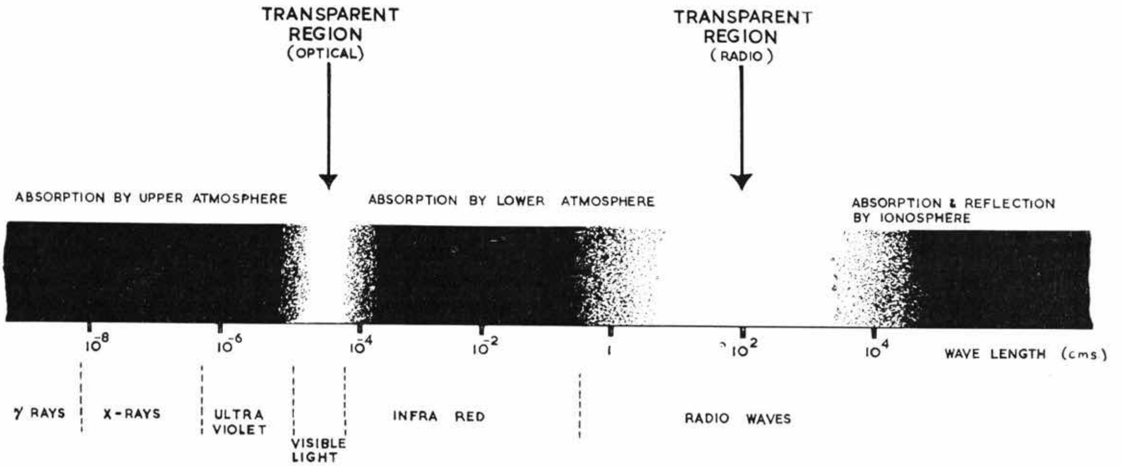


Fig. 1: The electromagnetic spectrum. The regions for which the atmosphere is opaque are coloured black

Fig. 2: The spiral nebula M 51

Fig. 3. As the Earth's rotation swept the aerial beams (of about 2° diameter) across the source, at a rate of one degree every seven minutes, the deflection of the pens showed an appreciable increase in the noise power reaching the aerial. This source is known as Cassiopeia A and it is the most intense in the sky. Even so, the deflections were produced in this instance by a power reaching the aerial of only 4.10^{-13} watts, and even if the receiver had been connected by lossless cables to aerials which collected all the power falling on the Earth, only two milliwatts would have been available for the measurement.

These records also show one of the major difficulties of this work. The position of the radio source derived from these records is very uncertain when one compares it with the high accuracy achieved in optical astronomy. This is because the aerials are not very large in comparison to the wavelength being investigated. The Jodrell Bank steerable telescope has a diameter of 250 feet or 43 wavelengths in this experiment. The giant optical telescope at Mount Palomar has a diameter of 200 inches, or about 100 million wavelengths for blue light. As the accuracy with which positions can be measured depends on the size of the telescope in wavelengths, the optical astronomer has a very clear lead here.

The lower trace in Fig. 3 is formed by combining the output of the two receivers to form an interferometer. The distance of 200 wavelengths between the aerials divides the combined beam into lobes, corresponding to the oscillations, or fringes, on the record. Instruments of this type can be used to improve the accuracy of the measurements of position, and they also give information about the angular size of the source.

The Nature of the Radio Sources

About 3,000 radio sources are now known, but it has proved extremely difficult to find many connecting links between this radio universe and the objects studied in optical astronomy. None of the radio sources is related to the naked eye stars, but where accurate radio positions have been measured, about a dozen radio sources have been identified with faint objects within the galaxy. Cassiopeia A is probably the remnant of a star which exploded within our own galaxy about 500 years ago and three other examples of such supernova* explosions are also known to give radio emission. The discovery that the tenuous neutral hydrogen diffused through the galaxy emits a spectral line at a wavelength of 21 cm. has provided a powerful new tool for the radio astronomer. It has made possible a measurement of the distance of Cassiopeia A, and it is used to map the spiral arms of our own galaxy, which cannot be seen by the optical astronomers because of the obscuring dust clouds.

Our nearest neighbouring galaxy, whose nucleus is just visible to the naked eye in the constellation of Andromeda, is a million light years away. A radio source has also been found in the position of the galaxy shown in Fig. 2, and of about 18 other external galaxies. The radio source called Cygnus A is much more intense than these (it

* *Novae are stars in which a great explosion occurs such that the luminosity increases suddenly by a large factor, which may be as great as 25,000. These stars return to their pre-explosion condition in a period of a few months. In a supernova the catastrophe is much greater, and a substantial fraction of the whole material of the star is blown off in a gigantic explosion.*

is in fact second only to Cassiopeia A) but its identification has proved extremely difficult. The optical object is extremely faint, and only just detectable with the great optical telescope at Mount Palomar. Photographs show two very remote galaxies in face-on collision at a speed of 500 km/sec. The mechanism by which the energy released by the collision is converted into radio emission is not known, but it must be extremely efficient, for the source is the second most intense in our sky, although it is 700 million light years away. Several other similar examples are known to give radio emission, and there is evidence that some of the fainter radio sources are objects of the same nature, which may be so remote that they cannot be photographed at all, even from Mount Palomar.

Radio Telescopes

Because we wish to study the faint radio sources less than one-thousandth part of the intensity of Cassiopeia A or fainter, aerials must be used which have a large collecting area, and a narrow reception angle, so that a faint source can be separated from its neighbours. The Jodrell Bank radio telescope is the largest of its type yet constructed, and it consists of a paraboloidal surface, 250 feet in diameter, which collects all the radio waves falling on an area of 5,000 square yards and reflects them on to a simple aerial at the focus. This bowl is

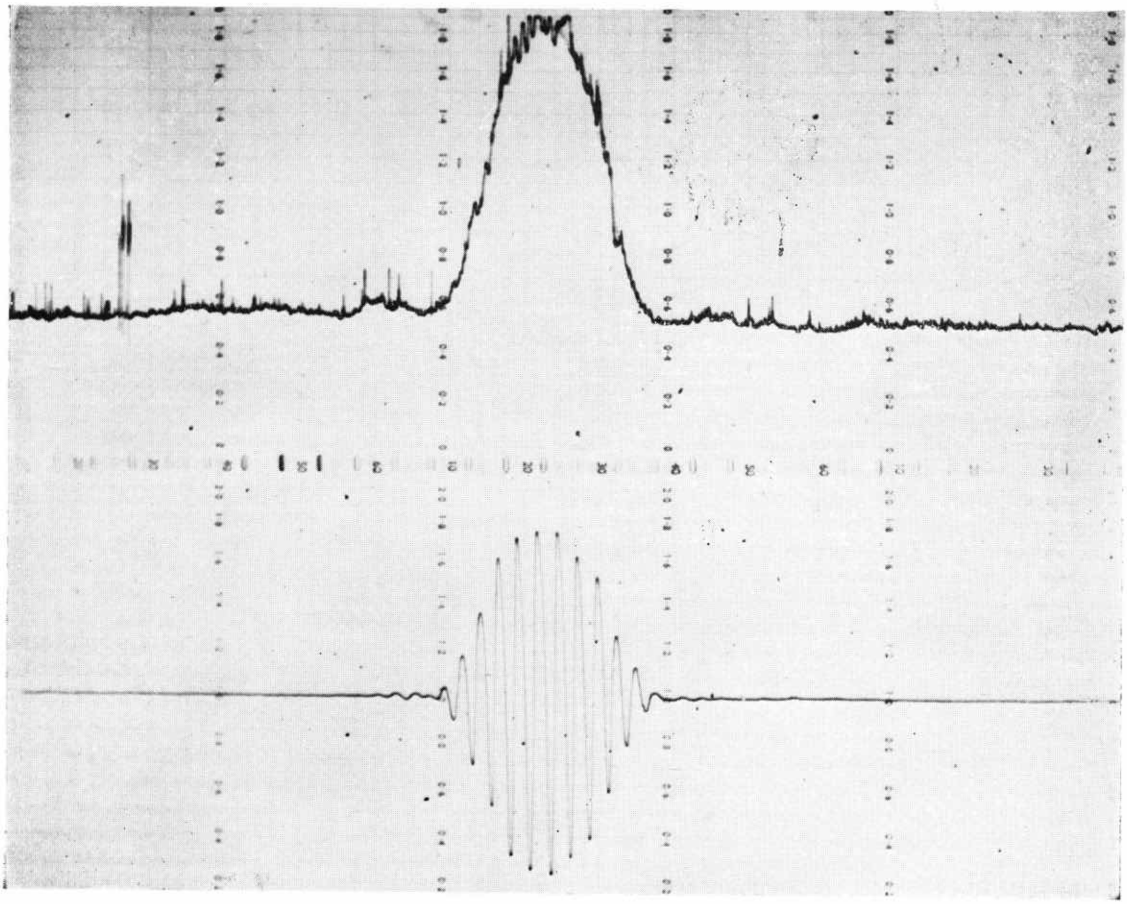


Fig. 3: Two types of record of the radio source Cassiopeia A

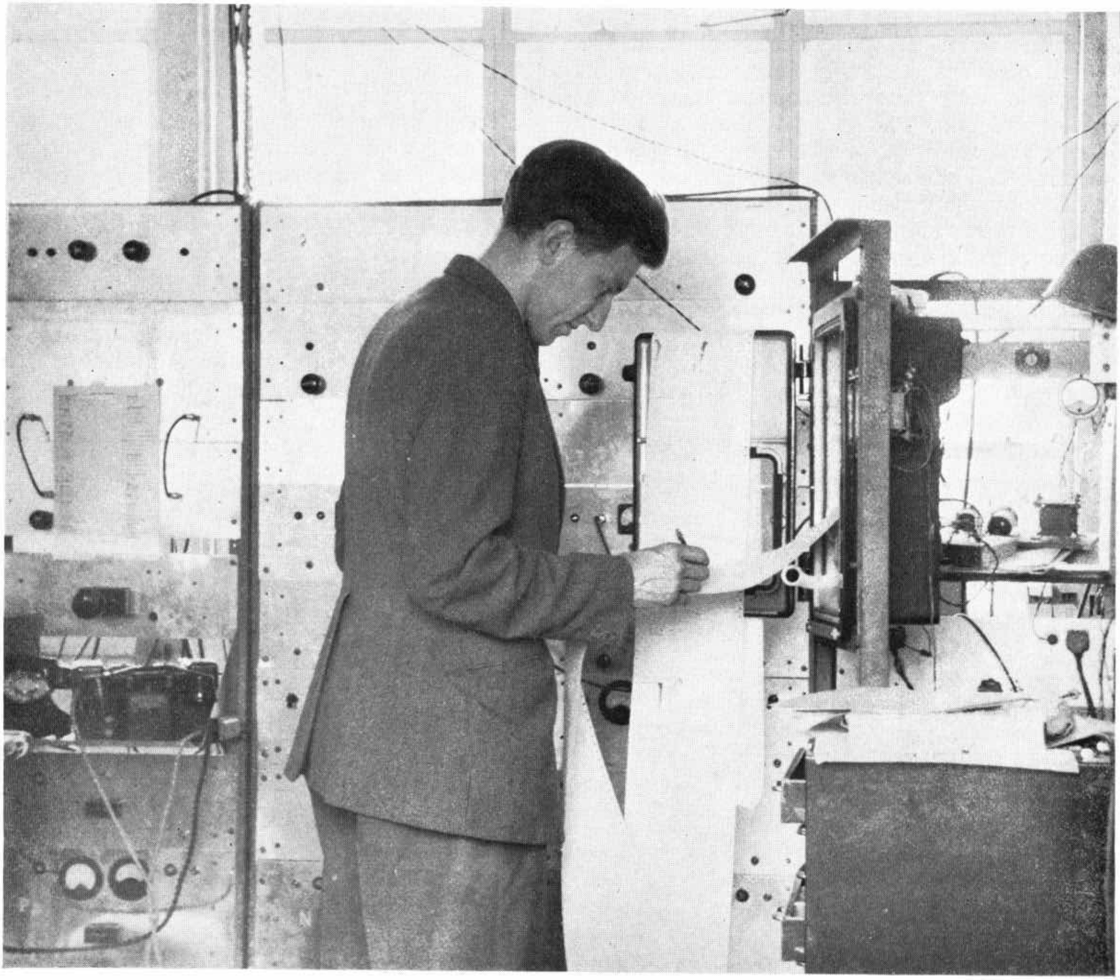


Fig. 4: Receiving and recording apparatus for the observation of radio sources

supported on towers 180 feet high, and the whole structure can revolve on a railtrack 300 feet in diameter. The weight of the movable structure is about 2,000 tons.

The telescope is fully steerable, and is driven by eight variable speed electric motors, each 50 hp. The control room houses a computer, which allows automatically for the Earth's rotation, so that the telescope can follow any point in the sky. The telescope will also perform scanning motions, and so build up a contour map of the radio sky.

A member of the team of controllers maintains a constant watch while the telescope is under power, and he has contact by Post Office telephone, by internal telephone, or by loud hailer with the laboratories and motor rooms on the telescope structure. He also has a direct line to the nearest meteorological office, for wind forecasts can be very important in planning the use of the instrument.

Radar Applications

The steerable telescope is also used for a number of radar experiments, in which its great aerial gain, and its manoeuvrability are invaluable. For instance, when it is connected to a suitable

transmitter, it can send pulses to the Moon and receive the echoes $2\frac{1}{2}$ seconds later. The echoes give information about the concentration of electrons in the Earth-Moon space, and recent experiments have shown how this varies during the day. The same equipment was used to track the flight and return to earth of the first sputniks (which were much more difficult targets than the Moon) and to provide design data for the forthcoming attempts to obtain echoes from the planet Venus.

Other radar equipments are used to study the short-lived trails left by shooting stars. These grains of sand or iron enter the upper atmosphere at speeds of 20 to 40 miles a second, so that air friction makes them incandescent. They are studied both for their astronomical interest as interplanetary matter, and for the information they can give about conditions in the atmosphere 50 miles above the Earth's surface.

Ready adaptability is the major advantage of the design of the telescope at Jodrell Bank and it has already found one unexpected application outside radio astronomy, in the work connected with the American lunar probes.

U.S. Probes Followed

As the daily Press soon discovered, a trailer of equipment arrived last August from the Laboratory of Space Technology of Los Angeles. During three New Moons since then the telescope has been taken from its normal work and connected to this equipment. It was completely successful in following the two probes which were launched by the United States Air Force, and which appeared above our horizon. The signals from the probes were recorded on magnetic tape, and were also decoded at Jodrell Bank, before transmission by Post Office teleprinter to the headquarters at Los Angeles and the observing stations at

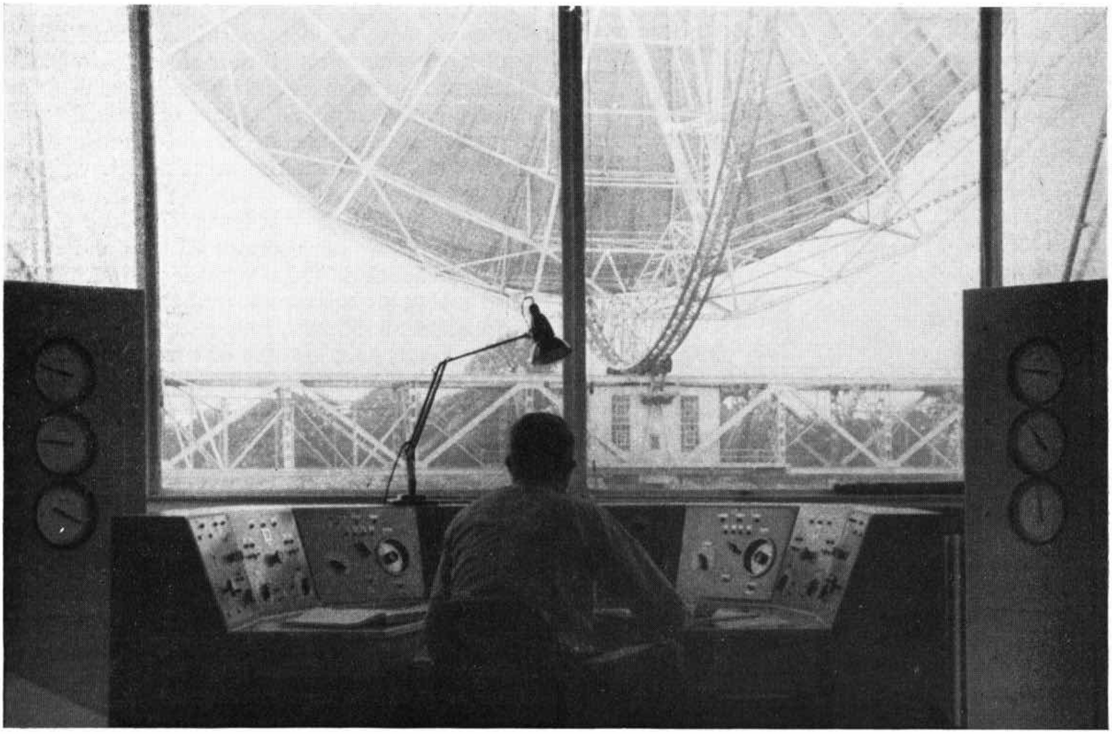


Fig. 5: The control desk of the radio telescope during an observation of the setting moon

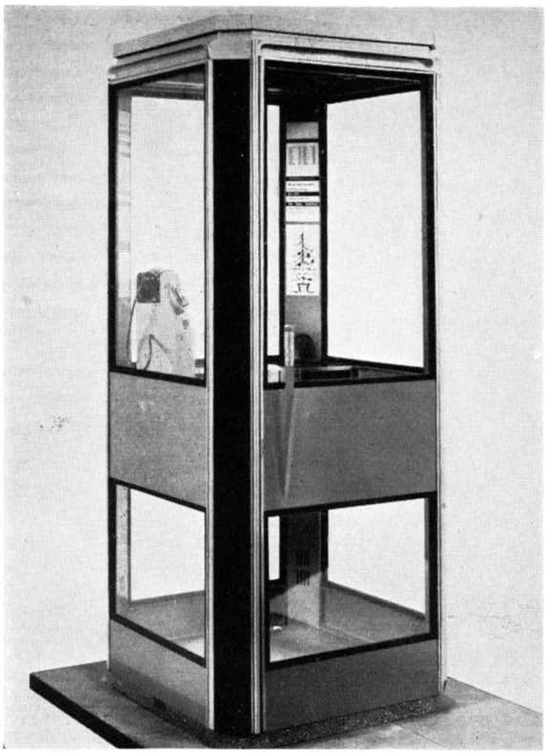
Singapore and Hawaii. Similar observations are planned when the U.S. Army launches its probes in the near future.

A Young but Vigorous Science

In 1932 the first experiments in radio astronomy were performed in the state of Ohio, by an engineer named Jansky. They attracted very little attention at first, but the new science he inaugurated has grown rapidly since 1945. There are now radio astronomical observatories in all the major countries of the world, and the International Astronomical Union devotes one of its Commissions to this new subject. Instrument development has been stimulated by the observational needs for very sensitive well-stabilised receivers, for high power pulse transmitters, and for large aerials of accurate geometrical form. There is now good reason to hope that the study of radio sources beyond the reach of the optical telescopes can contribute some decisive results to help our understanding of the evolution of the Universe.

The New Telephone Kiosk

The new kiosk designed by Neville Conder, F.R.I.B.A., A.A. Dip.(Hons.), M.S.I.A., is 7 feet 2 inches high (14 inches shorter than the present one) and is of anodised aluminium, with red panels. Designed to take the new trunk dialling coin-box with its modern telephone handset, it will be tried out in selected places to test public opinion.



Telling *The Times* what he had in mind Mr. Conder said that the glass panels (or walls) enable people to see the telephone from the outside and so recognise the purpose at once. There is no back-board, so the kiosk can be built without a blind side, allowing greater flexibility in use without introducing alternative door positions.

A kiosk, Mr. Conder considers, should have a similar appearance on all four sides. "Any strong differentiation between different sides would create a directional emphasis that might well cause architectural difficulties in some of the many types of positions in which the kiosk will have to be placed."

The telephone desk is lower than the present one and secretly incorporates all fuse and switch gear; incidentally, it also provides a brace in the horizontal plane at the most probable impact level.

Anodised aluminium, unlike cast iron (as in the present kiosk) does not rust or corrode.

The cut-off corners, which carry the information panels, enable the strong tubular aluminium columns to serve as low-level vents, secret conduits and rain-water pipes.

The design can easily have other kiosks added to it, making terraces of kiosks.

Mr. A. G. M'Bain, a Glasgow Chartered Accountant and an author, has to be away from home a great deal, travelling in England, the Continent, America and elsewhere. He sends frequent telegrams to his wife Irene—so has registered her as a telegraphic address: IRENE, GLASGOW.

The New Telephone

F. C. Carter, O.B.E., B.Sc., M.I.E.E.

Fig. 1: New Telephone 700 type (No. 706), 1958-59

ON MAY 14, 1958 THE ASSISTANT POSTMASTER General, in answer to a question in the House of Commons, said that with the co-operation of the manufacturers and the Council of Industrial Design, the design of a new telephone instrument had been completed. It would have an improved technical performance and would be made in a new and extended range of colours. First supplies were expected in the spring of 1959. Fig. 1 shows the new design: 700 type, No. 706.

Many people may well have wondered how this new telephone came to be designed, how it differs from existing types and how it came to be completed just now.

The present standard telephone instruments, shown in Figs. 2 and 3, are the 200 type ("200" is merely a type number given for convenience) and Bell Set No. 26, which can be fitted separately, and the 300 type instrument which can accommodate up to three push button keys for extension working. The key facility on the 300 type is particularly valuable for shared service working. Both instruments have the same transmission performance and use many common parts. They were both introduced in the late 1930s and they both give very good service.

However, as a result of advances in acoustics and engineering both during and after the war new and improved components became possible which if used in a telephone instrument could provide a worthwhile overall increase in transmission performance; also, the Post Office found that it could take advantage of this increased performance to use such instruments on lines of greater resistance. The subscriber could still be given the same overall performance as now but the increased resistance could be used to advantage in planning local line networks, when either longer lines of the same gauge conductors, or similar lengths of smaller gauge conductors, or a combination of both, could be used. With the continual rise in prices of copper, lead and other materials, the potential economic advantages seemed sufficiently great to justify proceeding with the development of such an instrument.

After exhaustive tests on various components at the Post Office Research Station for two or three years, 5,000 new instruments were ordered for field trial in 1955. They were to incorporate a new receiver, new mouthpiece, new induction coil and new balance circuit. The dimensions of the handset had been carefully studied so that the new mouthpiece would give the optimum performance in the normal speaking position. Arrangements were also made to accommodate a new transmitter when this became available.

Laboratory tests and trials of these instruments on official circuits showed that while they gave the anticipated increased transmission performance, some form of sensitivity control would be needed to avoid undue loudness on short lines. Various designs of suitable control elements were examined but most suffered from the disadvantage that they had to be connected in or out of circuit, depending on the resistance of the line. In practice this would mean that exchange areas would have to be divided into resistance zones, and fitters told whether the control elements should be left in circuit or not every time a telephone was fitted or changed. An added complexity would be that the

zones might be changed if the cables in the local network were replaced by those of different conductor sizes.

Eventually the Post Office staff succeeded in developing a unit which could be included in the instrument and in which the line current—which is a measure of the resistance of the line—could be caused to adjust the sensitivity of the telephone to the appropriate value. Several of these units were made up and fitted to the instruments on field trial and preliminary reports have confirmed laboratory results which showed that they are satisfactory in overcoming the difficulty.

One of the principal factors contributing to the improved performance of this new instrument is the new rocking armature receiver (No. 4T) developed by Standard Telephones & Cables. The frequency characteristics of this receiver, compared with earlier types (1L, 2P), are shown in Fig. 4.

By the time the field trials had started, it was also becoming increasingly apparent that if the new handset was to be more rounded in shape, partly for acoustic and partly for production reasons, it would not harmonize with the sharp razor edged lines of the 300 type telephone case. Some re-styling of the case would therefore be necessary, particularly as its appearance was becoming rather "dated". Another important consideration was that several new plastic materials had become available since the war and in introducing a new design of case advantage might be gained by making the new tools suitable for use with some of the newer materials.

Fig. 2 : Telephone No. 1/232 (200 type)

Taking all factors into consideration, the Post Office decided, therefore, that considerable advantage was to be gained by seeking a completely new design of instrument. A specification was prepared and the telephone manufacturers invited to prepare a new design. The principal points of this specification were that the design should include the new components then on trial and accommodate a control element if found necessary; the moulded parts should be designed to be made of new tough thermo-plastics; the handset should be as light as practicable; a new gravity switch capable of being readily operated by the new handset should be incorporated; an enlarged dial number ring was to be provided with a recessed dial; the instrument should be capable of accommodating one press button, and modern style cords should be used.

The decision to have only one press button was taken since it was found that the direct exchange line, shared service or P.B.X. extension installations, which together constituted more than 90 per cent. of the instrument requirements, could be met by this arrangement. This decision also allowed a smaller and neater design to be prepared.

Several attractive designs were received from the manufacturers and in collaboration with the Council of Industrial Design* Ericsson's design was selected as most nearly meeting the Post Office requirements. The Council, however, put forward some constructive comments on a number of the design features which it was possible to have incorporated before manufacture was started. In making its final recommendation the Council said that they were happy to recommend the acceptance of the design. All the main features specified had been included and at the same time recent improvements in manufacturing techniques had been incorporated. All moulded parts were free of metal inserts so giving the opportunity to adopt modern high speed injection moulding techniques. Another new feature was the use of uncoloured polymer plastic stock material to which pigments could be added as necessary to give the required coloured mouldings. Fig. 5 shows the final design of the handset.

** The Post Office consulted the Council of Industrial Design because the Council is a Government sponsored organization set up toward the end of the war to foster good design in British Industry, receiving a "Grant in Aid" and having become a recognized authority on good design. Although its primary purpose is to raise standards of appearance the Council also satisfies itself that any new product submitted for approval performs satisfactorily the purpose for which it is intended. Responsibility for the efficient performance of the new instrument, however, rests entirely with the Post Office.*

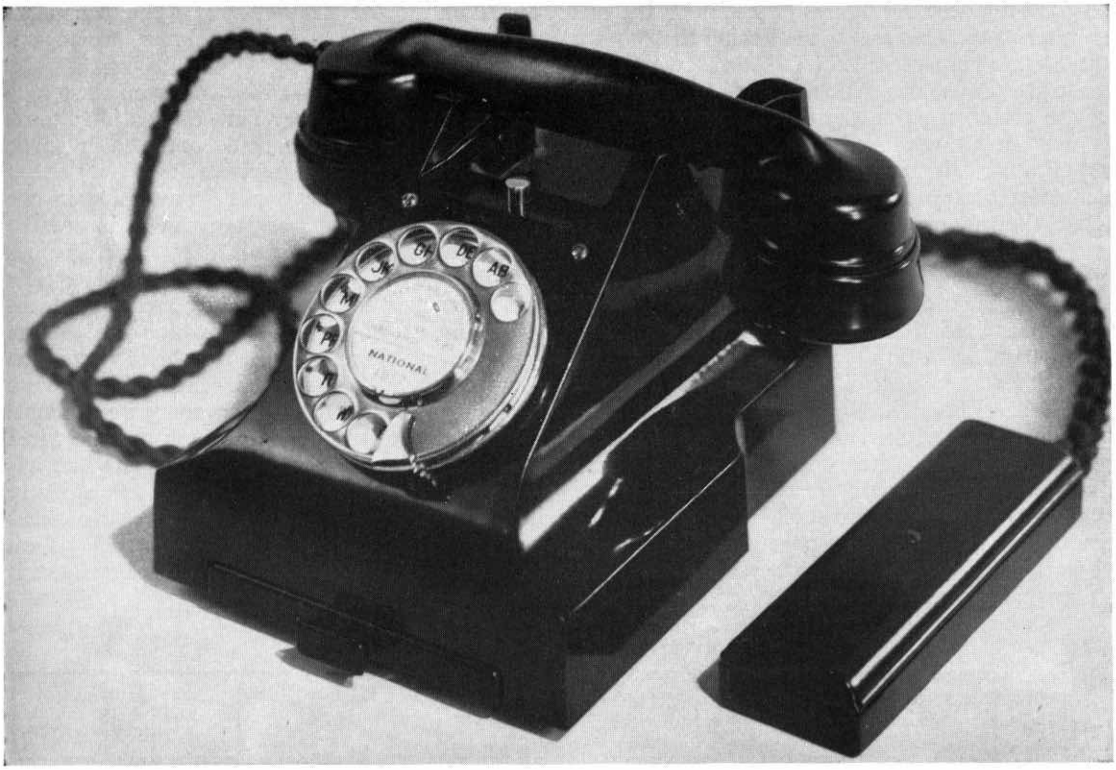


Fig. 3 : Telephone No. 312 (300 type)

In parallel with this work the Post Office had been examining in detail the various types of new moulding materials for such properties as strength, durability, effect of high and low temperatures, humidity, surface hardness and lustre ageing, effect of the use of ordinary domestic cleaning materials, ability to withstand contact with body acids, and so on. The choice eventually seemed to lie between modified polystyrene and an acrylic resin (Diakon) and bearing in mind all the above factors, Diakon was finally selected as the most suitable material for the initial supplies. Diakon has been used for coloured telephones for many years but is now becoming available in an uncoloured form as a plastic polymer stock to which pigments are added by "dry mix" techniques to give the required coloured moulding.

The new gravity switch is another interesting innovation; it is quite simple and extremely light in operation. It consists essentially of a relay type spring set with a lift comb mounted just underneath the plunger switch and coupled to it in such a way that a slight pressure performs the switching operation.

Among the other telephone designs submitted was one using a printed* wiring. This feature has many attractions from a production point of view and is considered to be one of the coming new techniques. The Post Office decided, therefore, that while it would standardize rigidly on the external shape and style of the new telephone it would accept alternative internal arrangements which could be either conventionally wired or could contain a printed wiring. Fig. 5 shows the internal arrangement of the printed wiring design. Most of the components were designed to be identical in both designs to facilitate subsequent repair by the Post Office Factory.

The use of the enlarged dial number ring

* *An illustrated description of the printed circuits process was given in "Printing Aids Electronics" by J. A. Lawrence in the Autumn 1956 Journal.*

obviates the need for figures or letters on the dial number plate. This assists in clearing the way for the adoption of a modified form of dial, which will make greater use of plastic materials for a number of the principal parts, the development of which is now in an advanced stage. Although initial supplies of dials may not be available when first deliveries of the new telephone instrument are made, they are expected to follow fairly soon.

Colour Choice

The problem then arose: what colours were to be standardized for the new instrument? Many different shades and tints were available and it was appreciated that choice of colour is largely a matter of individual opinion. However, stocking difficulties and costs precluded too wide a range and some reasonable compromise had to be found. Some limitation was possible by restricting the range of colours to those that were stable and fast to light, readily reproducible for repeat orders over long periods, easy to mould and reasonable in cost. From this a short list was produced and the co-operation of the Council was again sought in selecting a range of seven colours, which was finally agreed.

These colours are two-tone green, two-tone grey, light ivory, lacquer red, concord blue, topaz yellow and black. With all colours the cords will be close braided in grebe grey.

The new instrument will be available in one basic form only, but a single press button can be added when required. Also, by an ingenious arrangement, other parts can be added internally and so the telephone can be converted to meet the requirements of other types which are stocked separately in the 300 series for various extension arrangements. This facility is achieved by the use of a range of adapters which comprise a simple combination of components which may be wired into the instrument wiring by means of an additional terminal strip. These adapters are very inexpensive and provide a quick and cheap means of converting one type to another. A typical adapter used to provide shared service facilities is shown in Fig. 6.

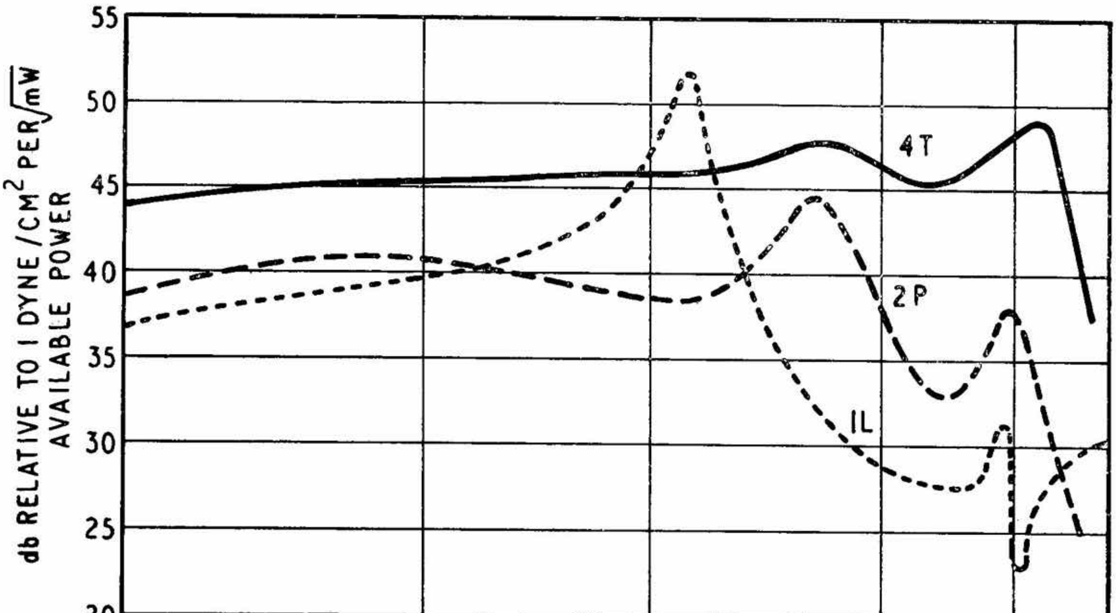


Fig. 4: Sensitivity/frequency characteristics of types 1L, 2P and 4T Receiver Insets

Fig. 5 : New Telephone 700 type, No. 706 : printed circuit board, base and dial

Considerable advances have been made since the war in the insulation of wires and cables and several new materials which can be used for cords as well have become available. These developments have been kept under constant review with the result that once the decision was taken to have the new telephone, no delay occurred in producing new types of cords. The new handset cord has tinsel conductors, like the existing cords, but insulated with polyvinyl chloride (P.V.C.). The four insulated conductors are braided overall with either nylon or terylene. The handset is designed to be hollow so that the cord will pass through and allow easy connexion direct to the receiver terminals, thus avoiding the difficulty and expense of moulding connecting wires and terminals into the plastic of the handset which occurred in the earlier design. The main instrument cord also has tinsel conductors individually insulated with P.V.C. and braided overall with nylon or terylene. Clinched-on spade terminals are used for terminating the ends of all conductors, thus obviating earlier laborious processes of manually terminating each conductor end with a wire bound loop. Special clamping arrangements are incorporated in the telephone instrument to take the strain of any direct pull which might otherwise result in a disconnexion. The Council of Industrial Design agreed that the

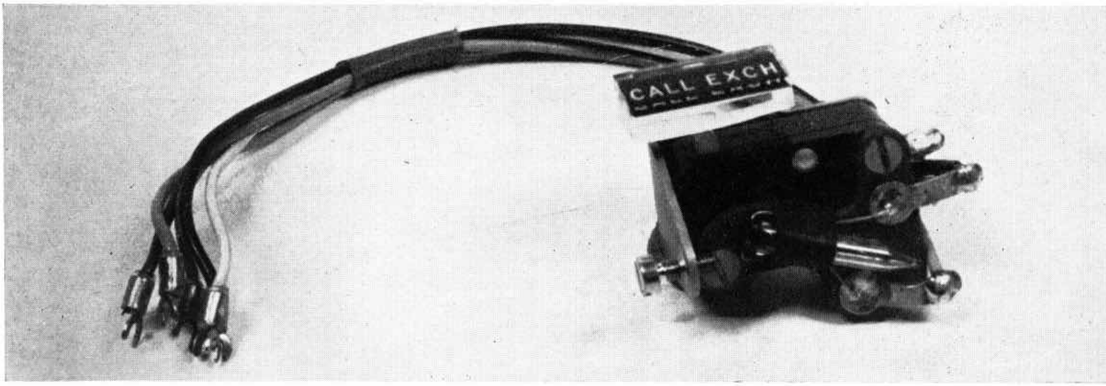


Fig. 6 : Adapter for Shared Service (New Telephone 700 type, No. 706)

single colour of grebe grey would be a suitable match for all the whole new colour range of instruments.

Readers may well ask, what is being done to cater for other extension plan number arrangements which are provided in the 300 series? As mentioned already, several of the more popular arrangements will be catered for by the new system of adapters. The Post Office and manufacturers are actively examining the possibility of catering for the more complicated arrangements and suitable arrangements will probably develop in the near future. One very promising method of providing for Plan 7 facilities is by means of a plinth underneath the telephone but other proposals are under consideration. Present investigations are sufficiently promising to show that in the comparatively near future a range of instruments having the improved characteristics which will completely supersede all the existing types will be produced.

A final question which could perhaps be raised is, when will the new instrument be available to the bulk of subscribers? Here there is a major difficulty since the Post Office possesses about seven million of the 200 and 300 types of instruments which are giving very good service and which it cannot afford to scrap with the present limitations upon capital investment. The bulk of the first supplies will therefore be produced in colour and will be available to subscribers prepared to pay the new charges. It would not be unreasonable to hope that this charge might be reduced in due course when the new telephone will come into more popular use. In the meantime, no more orders for the older types of instruments are to be placed.

To conclude, all the telephone manufacturers have contributed to this development and preliminary reports indicate that the new telephone has been very favourably received by overseas administrations and that it is considered to be comparable in design and performance with the best produced by any branch of the telecommunications industry in the world today.

Critics Praise "Medico" Television Film

The B.B.C.'s three-quarters-of-an-hour television documentary, Medico, a story of the Post Office free ship-shore medical service, produced by Robert Barr on January 7, got a very good Press—"A colourful slice of television . . . bringing recognition to a little known service" (*Daily Mirror*) was typical of comments.

The story of its production, told in the February *Post Office Magazine*, shows that shots were taken at Burnham and Land's End Radio, involving considerable co-operation by staff while normal work was in progress. Some Post Office staff appeared in the film.

"The treatment was conventional", commented the *Daily Mail*, "with actors playing the parts of unremarkable men going about their normal business. The action was less concerned with building up tension than with showing how the system works."

Telephone Service made £5.3 million surplus

THE *Post Office Commercial Accounts and Report* for 1956–57 appeared in a Post Office Red cover, instead of the usual "Blue Book" blue. With the 1957–58 *Accounts* a further step has been taken in more attractive presentation by prefacing the *Accounts* with a 15-page outline of the main financial results and operational developments of the year, illustrated by diagrams.

This new report emphasizes that 1957–58 was a year of "steady progress in the mechanization of many Post Office services. The groundwork was laid for the complete automation of the telephone system". Developments in the telecommunication services include group charging and extension of the local call area (introduced on January 1, 1958); the start of work on the first all-electronic exchange (Highgate Wood) and the bringing near to completion of the automatic telex exchanges in Leeds (opened on September 1, 1958) and London.

Completion of the Manchester–Glasgow, Bristol -Exeter and Derby–Leeds cabling schemes, and provision of the Cardiff–London and Manchester–Glasgow television links for the I.T.A. are also reported. Overall, more than 1,000 additional circuits of more than 25 miles each were provided; the total mileage of trunk circuits in use was increased by some five per cent.

"Development of the coaxial cable", says the report, "made a large reduction in the cost of long distance telephone conversations. In modern coaxial cables up to 960 simultaneous conversations can be transmitted over a pair of coaxial tubes of which there may be several in each cable.

"But engineering development is now being pushed a stage further. By reducing the spacing between repeater stations from six to three miles the capacity of existing cables between some main centres will be increased so that the same pair of tubes will cater for about 2,400 simultaneous conversations or 1,000 conversations plus a two way television channel".

The amount of automatic telephone equipment was increased by 43 per cent., while the actual maintenance effort increased by less than two per cent. between April, 1952 and April, 1958.

As a result of research in Post Office laboratories part of the terminal equipment of the transatlantic telephone cable is being redesigned so that the cable will provide 48 instead of 36 circuits, without appreciable loss of clarity.

Financial Results

The overall surplus for 1957–58, on an income of £389.2 million, was £2.6 million.

While the Postal Account shows a deficit of £0.5 million and the Telegraph Account a deficit of £2.2 million, the Telephone Account shows a surplus of £5.3 million.

Telegraph income was £18.6 million against £20.8 million expenditure. Income was £0.3 million higher, and expenditure £1.0 million higher than in 1956–57.

The income from the telephone services rose by £17.9 million to £180.6 million, expenditure rising by £12.7 million to £175.3 million.

Capital Expenditure

On telegraph plant, the Post Office spent £2.2 million—£0.7 million more than during the previous year.

Expenditure on telephone plant, at £76.6 million, was £3.3 million lower than in the previous year. An analysis of this expenditure under various types of plant shows:—

	1956–57 £ *million*	1957–58 £ *million*
Trunk and junction circuits	17.0	15.8
Local lines	22.7	21.4
Subscribers' circuits ...	19.9	18.7
Exchange equipment ...	17.9	19.6
Overseas and miscellaneous	2.4	1.1
Totals	79.9	76.6

TELEPHONE SERVICE: 1957-1958

	1956–57	1957–58
NUMBER OF LOCAL EXCHANGES AT END OF YEAR		
Automatic ...	4,784	4,897
Manual ...	1,196	1,099
Total ...	5,980	5,996
NUMBER OF AUTO-MANUAL AND SEPARATE TRUNK EXCHANGES AT END OF YEAR	276	278

	1956–57 '000	1957–58 '000
NUMBER OF EXCHANGE CONNEXIONS AT END OF YEAR ...		
On automatic exchanges ...	3,429	3,483
On manual exchanges ...	1,045	1,017
Total ...	4,474	4,500
ANALYSIS OF EXCHANGE CONNEXIONS UNDER RENTAL CATEGORIES, &c.		
Business Rate —exclusive service ...	1,622	1,642
shared service ...	153	144
Residence Rate—exclusive service ...	1,539	1,575
shared service ...	1,034	1,009
Post Office Service ...	56	58
Call Office ...	70	72
Total ...	4,474	4,500
NUMBER OF STATIONS AT END OF YEAR		
Exchange Service ...	7,167	7,300
Private Circuits (telephone and telegraph) ...	59	61
Total ...	7,226	7,361
NUMBER OF APPLICATIONS FOR EXCHANGE CONNEXIONS DURING THE YEAR ...	388	345
NUMBER OF APPLICATIONS FOR EXCHANGE CONNEXIONS OUTSTANDING AT END OF YEAR ...	246	171
TRAFFIC—NUMBER OF CALLS		
Inland:—		
Trunk ...	321,356	326,828
Local ...	3,743,000	3,671,000
Overseas:—		
European cable services:—		
Outward ...	2,091	2,221
Inward ...	2,025	2,174
Transit ...	36	46
Radiotelephone and Extra-European cable services:—		
Outward ...	148	201
Inward ...	158	214
Transit ...	112	204
Short range radiotelephone calls with ships:—		
Outward ...	10	11
Inward ...	75	86
Total ...	4,655	5,157

All these figures are net after allowing for the residual value of assets displaced. The corresponding gross additions to telephone plant assets was £84.6 million.

Fixed Telephone Plant Assets

Telephone plant assets at March 31, 1957, at historical cost, amounted to £729.3 million. With the addition during the year of £84.6 million and after allowing for writing out £18.2 million for life expired plant, the book value of telephone plant rose to £795.6 million at March 31, 1958.

Depreciation

Provision for depreciation, based on the historical cost of telephone plant at March 31, 1957 amounted to £29.0 million. This was raised by a further £16.3 million—the additional amount estimated to be necessary—so that the total provision made in the year would reflect a year's wear and tear at the current value of the assets.

Traffic

Statistics of telephone traffic for the year, compared with 1956–57, are given in the table opposite.

Inland telex calls rose from 2.1 million to 2.8 million, but inland telegrams fell from 16.8 million to 15.2 million.

Oversea telex calls also increased, from 2.7 million to 3.3 million, but there was a slight decline in the number of telegrams with overseas administrations and cable companies, including ship-shore radiotelegrams, from 21.5 million to 20.9 million.

Staff

Telegraph staff was reduced from 6,983 at March 31, 1957 to 6,762 at March 31, 1958 and telephone staff from 52,345 to 50,290. There was also a slight reduction in engineering staff, from 88,835 to 87,975. These figures include part time staff as a half each.

HOSPITALS BROADCAST SERVICE

For six years, a member of the Post Office—Norman Pryce, Engineer on Cardiff Telephone Manager's staff—has organized a Hospitals Broadcast Service, enabling patients in hospitals in Cardiff and district to hear running commentaries on sports features. During the period some 300 commentaries have been broadcast to patients in many hospitals.

In 1953 Cardiff City Football Club asked the City Supporters' Club (of which Mr. Pryce is a member) if a service could be started. Money was raised to pay for renting Post Office lines; the hospitals were asked for their blessing. Rediffusion (Wales) freely provided a Vortexion Three Stage Mixer for modulating standard moving coil microphones and matching transformers and switching equipment at hospitals. In 1953–54 matches were broadcast from Ninian Park. In co-operation with a similar service at Highbury, London, the Arsenal-Cardiff City fourth round Football Association Cup match was broadcast towards the end of the season.

In May 1956 the Erskine-Richardson boxing match was broadcast from Maindy Stadium, Cardiff, to 20 hospitals as far from Cardiff as Swansea, Carmarthen, Neath, Bridgend, Pontypridd and Brecon.

"It is with a feeling of pride", writes Mr. Pryce, "that, when reviewing in the Executive Committee the activities of the Hospitals Broadcast Service, mention is made of the great help afforded by the various departments of the Post Office . . . Interlinking with hospitals systems in any other city or town can be arranged in a few minutes conversation with the Sales Branch, followed by a letter confirming the venue, the time of link up and so on". The Cardiff service has, on three occasions, been hooked up with Leeds Hospital Relay Service.

The service, usually broadcast to 14 hospitals, costs about £500 a year for line rentals and has an estimated audience of some 6,000 patients. Most of the money is raised by voluntary workers and commentators selling on the ground, before a game, penny tickets for prizes connected with Soccer or Rugby.

Hospital broadcast services run also in Bradford, Liverpool and Plymouth.

Developing Service in Nigeria and the Southern Cameroons

W. G. G. Rollason

NIGERIA (AND THE SOUTHERN CAMEROONS which are under United Kingdom Administration) form a territory of about 373,000 square miles lying a little north of the equator, bounded on the south by the Gulf of Guinea and extending northwards for a distance of nearly 700 miles. The total population is over 32 million. The area comprises swamp forests in the south, rain forest, highland and grassland in the middle regions and desert in the north. There is a wide range of climatic conditions. In the north the weather is hot and dry, the heat relieved annually by the "harmattan", the dusty wind which sweeps over the Sahara during the comparative coolness of the North African "winter". In the south the more moderate temperature, which reaches a peak of about 95 degrees, is accompanied by a high degree of humidity. The Southern Cameroons has 100 inches of rain a year. The country is rich in natural resources and fertile and its commercial development is rapidly gaining momentum.

Nigeria has had a variety of forms of Government since the first occupation by the British in 1861. It now has a federal constitution, established in 1952. The seat of the Central Government is at Lagos and there are three Regions, the East, the North and the West, with seats of Regional Government at Enugu, Kaduna and Ibadan respectively. The Nigerian Posts and Telegraphs Department is responsible for telecommunications throughout the country.

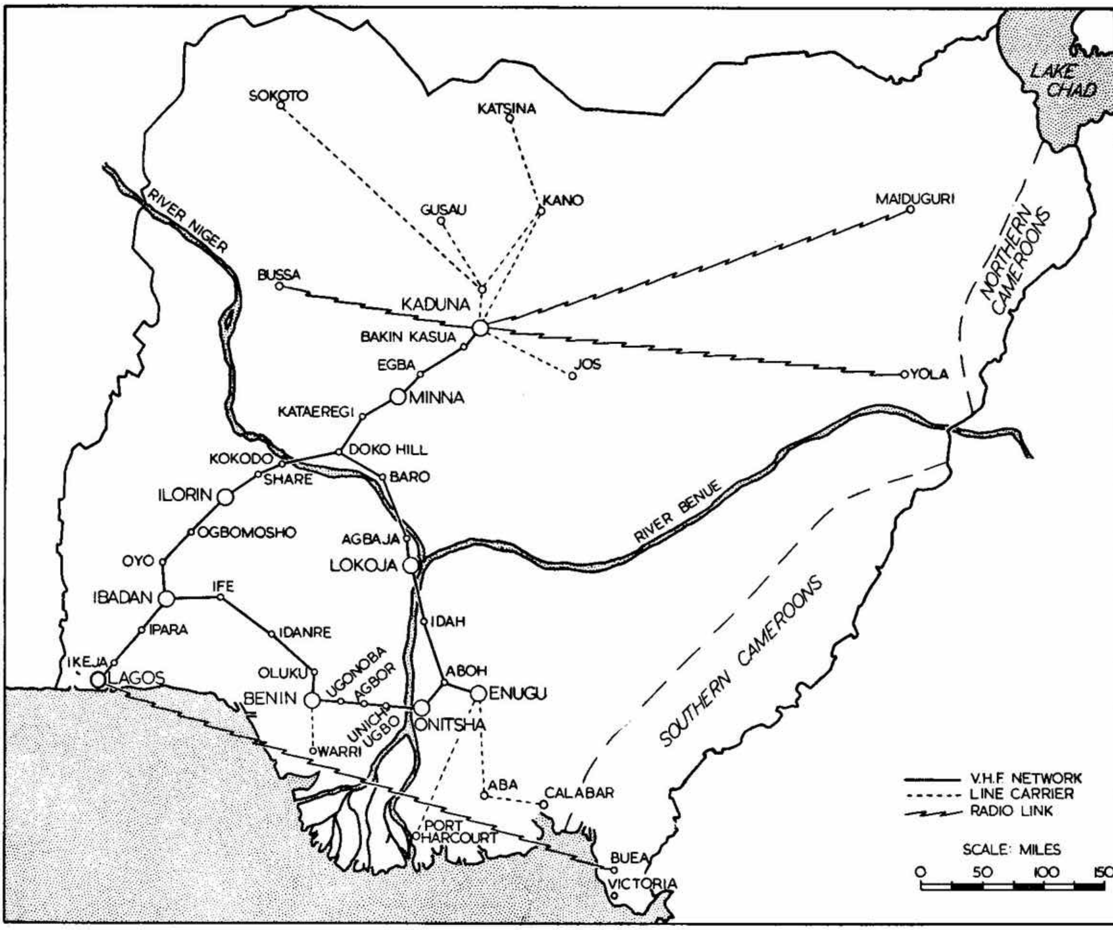
Nigeria's ancient communications were by water, coastwise through the complicated network of lagoons and reefs which forms its southern seaboard and into the interior through the Niger River and its great tributary, the Benue. In modern times rail and road communication systems have been constructed and more recently an extensive internal airways system has been established.

The great size and as yet undeveloped character of the country is still to be reckoned with despite the advances which have been made in physical transport and it will readily be appreciated that the needs of commerce for telegraph and telephone services spanning the territory are most acute. Government has fully realized that such services, operating efficiently, are absolutely essential to the industrial and commercial progress of the country, and has approved a large scale programme of development to extend the services on the most up-to-date pattern.

Twin VHF for Trunk Service

The basis of the plan of telecommunications development in Nigeria must be the trunk system since the urgent need is to overcome the great distances. The backbone consists of a network of twin VHF radio paths interconnecting in a triangular form the regional capitals at Enugu, Ibadan and Kaduna and with a spur from Ibadan to Lagos. The system provides for a maximum of 36 channels on each path. In due course the Lagos-Ibadan section will be replaced by a UHF system to extend the ultimate capacity to 480. The network has 10 repeater stations and 20 terminal stations. Carrier systems working on land lines connect up the important centres not situated on the VHF system.

The existing telegraph service consists of a number of point-to-point teleprinter channels interconnecting important centres (Zone and Group Centres) and minor channels worked by



Skeleton communications network showing principal towns and villages connected to the trunk system

key and sounder or telephone-telegram transmitting into the trunk centres. These arrangements have grown up over the years and do not represent a unified system. Long distance messages have to be re-manipulated as many as three or four times and while transmission time is fairly good over the main channels, it is decidedly poor over the more circuitous routings.

A great improvement in the service between main centres has resulted from the sound reliability of the VHF system but in many other places there is a definite need for regenerating the signal at intermediate re-transmission points. Owing to training difficulties it would clearly be desirable to eliminate or at least drastically to reduce the use of the morse key and sounder. These considerations and the positive continuous increase in the demand for telegraph service are the basic considerations which had to be taken into account from the service point of view in planning a re-modelled system.

The question of growth of telegraph service deserves special comment in view of the fact that one generally regards this service as steadily giving way to the competition of other means of communication. The slow and difficult physical communications impose a severe handicap on the postal service which has a much more difficult task than in Britain where distances are relatively short and transport facilities more highly geared.

In Nigeria, therefore, the telegraph service is likely to be used for messages of a standard of urgency which in Britain could be satisfied by the postal service. Telephone development too is only now starting—there are at present less than 30,000 working telephone instruments in the country—a density of less than 0.1 per cent. of the population.

The present annual traffic dealt with by telegraph under these conditions is about 3,000,000 messages a year or fewer than nine telegrams a year for every 100 persons. The peak of inland telegraph traffic in Britain (1946) was about 130 telegrams per annum per 100 persons and was reached when telephone density was under 10 telephones per cent. of the population. Another feature to be taken into account is the rapidly increasing literacy of the people. It is for these reasons that a telegraph system to provide substantially increased capacity has been planned in Nigeria at this time. In actual fact the overall capacity of the system as planned is, in general terms, about 7,500,000 messages a year or 23 messages per 100 persons.

Torn Tape Relay System

The type of telegraph system chosen is the torn tape relay system. Relay centres are being established at all of the Zone and Group Centres. Minor telegraph offices will send their traffic to these centres by teleprinter, telephone-telegram, facsimile, or in a few offices, by morse key and sounder.

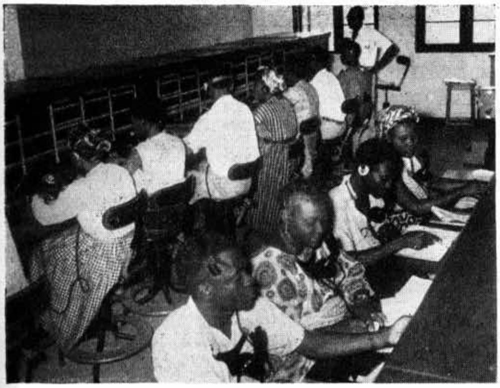
The system will provide that no telegram will have to be operated more than once by teleprinter or perforator keyboard. Telegrams received at the Zone and Group Centres by any means other than teleprinter will have to be "perforated up" by hand. Telegrams coming in to the relay centres over teleprinter channels will be taken on printing reperforators direct. Telegrams accepted over the counter at relay centre offices will be "perforated up" directly on manual perforators. The printed message as well as the perforations will appear on the tapes. The tapes will be numbered by automatic numbering machines. After the initial keyboard operation, transmission to the final destination teleprinter will be entirely by tape transmission. Extension to the minor offices will be a reversal of the collection procedure and will sometimes involve final transmission by telephone-telegram, facsimile or key and sounder.

This system offers the possibility of providing private teleprinter circuits for large users of the service to facilitate acceptance and delivery of telegrams. A subscriber's teleprinter may work through an automatic concentrator at a relay centre to a battery of printing reperforators. Messages sent would be received on perforated and printed tapes and transmitted automatically to the destination office for delivery, or, when addressed to another teleprinter renter, direct to his machine. Such communication between two teleprinter renters approximates to a telex service since it has been noted that commercial executives who do rent telex installations rarely use them for direct "conversational" (question and answer) communication. The approximation to a telex service will be valid, of course, only if the time of transmission from teleprinter to teleprinter can be reduced to a very few minutes more than the actual time required for keyboard operation; such short transmission times are definitely expected to be achieved between all of the main centres in this system.

The development of the telephone service in Nigeria presents many problems arising from the compression into a few years of a process of expansion and technical advancement which in European services has been spread over a very long time. To meet the requirements of the current plan the present total of 30,000 telephones in the country must be increased to 60,000 by 1962 and to 180,000 by 1980. Commercial and industrial progress in Nigeria is so rapid that the precise shape of future development cannot be positively foreseen. A new industry is founded or new mineral deposits are discovered in a particular area and a new centre "mushrooms" in a very short time. It is proverbially difficult to produce accurate subscribers' development figures in any circumstances. In Nigeria, as in all rapidly advancing telephone systems, it is doubly difficult.

One feature which does make the task a little easier is the presence of an overwhelming demand for service in all parts of the country. This at least ensures there is a "sale" for every telephone provided and there is therefore small risk of financial loss from overprovision of plant—at any rate in the larger centres. The problem is to ensure that essential commercial and industrial needs do not suffer from under-provision. The present development plan represents the result of consultation with various advisory bodies and it has been designed to meet as far as possible variations in the pattern of development.

Only a few years ago the traffic carrying capacity



Trunk Exchange LAGOS **Central Telegraph Office**

of the trunk telephone network was so restricted that a long distance call was the prerogative of a small number of subscribers to whom operational preference was accorded. Even then delays were of the order of many hours. The expansion of the trunk system from these meagre resources to the more generous provision of channels made available by the VHF network is already under way, although full exploitation will depend on the installation of new trunk exchanges to provide adequate terminal and traffic handling capacity. Delays in the trunk service are still excessive by normal commercial standards—up to an hour between main centres at peak periods—but the service is at least effective for all subscribers.

The growth of traffic also exhibits a marked relationship between the speed of the service and the quantity of traffic offered. As the service improves it is used more and a temporary increase in delays occurs which partially eliminates the improvement until the next augmentation of the trunk system. So the growth of traffic follows a step-shaped curve and it would appear that the progress can be regulated by simply providing more facilities and improving the quality of service.

At present Nigeria has 107 exchanges, five of which are automatic. (Four of these automatic exchanges are in Lagos area—a main and three Discriminating Selector Repeater satellite exchanges.) The remainder of the exchanges are manual, the majority of them magneto and non-multiple. Some of them are antiquated and long past their economic life. The current programme, to be completed by 1962, includes the installation of 13 major automatic exchanges and 24 Rurax (Rural UAX) exchanges. By 1962 over 75 per cent. of the subscribers will be on automatic exchanges.

At present the system is losing money and the current five-year (1955-60) economic programme provides for the investment of £6.8 million for telegraphs and telephones together. This is a very large sum for this country especially when it is considered that until recently the revenue was so small that there was no prospect of achieving commercial operation of the services. A new tariff was introduced in February 1958 and this, with the improving facilities and growing demand, offers a positive encouragement that commercial operation will be achieved within a reasonable time.

This was the first tariff revision since 1951. The old tariff was uneconomic, more complex and outdated by world standards. For instance, local calls in Lagos were one penny each and the rest of the exchanges were not on the message rate. The main items of the new and simpler tariff are:—

Quarterly rental of an exchange line		£4
Local Call Fee ...	... ...	3d
Trunk Call Fees	0- 10 miles ...	3d untimed
	10- 20 ,, ...	9d for 3 minutes
	20- 40 ,, ...	1s 6d ,, ,,
	40- 80 ,, ...	3s 0d ,, ,,
	80-160 ,, ...	5s 0d ,, ,,
	160-320 ,, ...	7s 6d ,, ,,
	Over 320 miles	10s 0d ,, ,,

An important feature of the tariff is that the scale of trunk charges will permit the introduction of time pulse metering of trunk calls on a basis of 3d for each $4\frac{1}{2}$ second period at the maximum rate. Time pulse metering in connection with subscribers' dialling will be introduced between Lagos and Ibadan (in the charge step 3s. 0d.) in 1959.

The table lists the past and estimated future revenue:—

Past and Estimated Future Revenue from Telephone Service in Nigeria

(Nigerian £1 = £1 sterling)

Actual		£
	1945-46	73,250
	1946-47	78,700
	1947-48	83,000
	1948-49	108,200
	1949-50	115,300
	1950-51	136,000
	1951-52	147,000
	1952-53	209,200
	1953-54	136,800
	1954-55	275,300
	1955-56	313,300
	1956-57	458,200
	1957-58	540,200
Estimated		£
	1958-59	1,000,000
	1959-60	1,400,000
	1960-61	2,000,000
	1961-62	2,300,000

Apart from the Lagos-Ibadan route, trunk dialling by subscribers is to be restricted at present to traffic between Rurax exchanges, their parent exchanges and other dependent Rurax exchanges on the same parent. Further trunk dialling by subscribers will follow in the next programme after 1962 when it is expected that a fully developed trunk system will be ready to carry the load. In the meantime, except for the items quoted, operator dialling will be applied to all trunk routes.

The average telephone in Nigeria shows an abnormally high annual revenue factor (rental plus call fees). Under the old tariff which has now been supplanted this figure stood at £16 6s a year. The factor is of course connected with the calling rates which also are extremely high compared with European figures. The reason for these conditions lies no doubt in the shortage of telephones. Where 10 telephone instruments are needed and only one exists there is a tendency to try to make the one do the work of 10, the subscribers allowing the use to others. The result is a concentration of traffic and very high earning power from each telephone.

International telephone and telegraph services are operated by Cable and Wireless Ltd. The gateway telephone exchange is at Lagos and international telephone and telegraph traffic is transferred between the cable office at Lagos and this gateway exchange, or the Central Telegraph Office, as the case may be.

The Nigerian Posts and Telegraphs Department is responsible also for the Aeronautical Service, which provides telegraph communications between airports for the aviation and meteorological services as well as ground-to-air wireless telegraph communications (air guard). This service is not extensive but absolute reliability is of the first importance. The operations are closely prescribed by the regulations of the International Civil Aviation Organization (I.C.A.O.).

The organization of the Department is based on a Central Headquarters office at Lagos and territorial offices at Enugu, Kaduna and Ibadan. The territorial offices carry out field duties directly but as much responsibility as possible is devolved to them so that they bear some of the functions of a regional headquarters in the United Kingdom. The Lagos Federal Area is administered by a Telecommunications Manager who is responsible for all telecommunications functions in the Area including engineering.

The prospect of independence in 1960 is naturally accompanied by a keen desire by the Nigerians to manage their own affairs and to replace the expatriates in the Civil Service by Nigerians as early as possible. As a result there is a strong emphasis on the preparation of selected Nigerians who exhibit aptitude for absorbing intensive training to fit them for promotion to the higher posts in the shortest possible time.

As a result of the natural impatience to effect this "Nigerianization" of the Civil Service, Nigerian staff must be trained at a rate which with European staff in a European administration would be considered impossible. To meet this requirement as far as possible the operational procedures of the telecommunications services have been cut to the simplest and most elementary minimum—even at the executive level—on the argument that an unrefined system that works is preferable to a refined system which does not. To quote an example, telephone call valuation is based on a system of standard values for every type of telephone transaction, the schedule of which can be adjusted as necessary from a central office to eliminate the necessity for individual calculations to be made in traffic offices.

To meet the pace, the Nigerian officers must also carry a load of work during their training and in the Telecommunications Branch a system has been devised of providing a group of European training officers each of whom will be responsible for training a group of Nigerian officers and for

guiding them in the performance of effective work. The trainees therefore receive directions from a superior, but have at hand a training officer to whom they may turn for guidance and help. The system is difficult and, by United Kingdom standards, clumsy but it meets the needs of the situation and there is solid gain to the Nigerian in a form of training which relies more on actual practical exercise than on mere teaching by lecture.

To summarize, the telecommunications services in Nigeria are in great demand to meet the rapidly increasing needs of the developing economic and social system. Possibly this demand is even more pressing than in more developed European countries. They must therefore be expanded in the shortest possible time and as they expand and improve they generate even greater demand for service. While this "forced growth" expansion is being pursued, Nigerian hands are being trained more and more to hold the reins. These are the present circumstances. It will be allowed that the problems are sufficiently difficult. For the Briton engaged in Nigeria during these years of progress and transition the work is interesting and rewarding in the extreme.

New Continental Automatic Switching Unit

A Continental automatic exchange was brought into use last November in Faraday Building, London.

This enables operators in European exchanges to dial direct to subscribers in London and the larger provincial cities. Similar exchanges now being installed in Europe will enable our Continental exchange operators to dial direct to European subscribers.

This important advance in automation of the Continental telephone service will speed the service and will progressively reduce the number of operators now required to operate incoming calls.

The Continental automatic exchange follows from a field trial conducted since 1952 on the London-Amsterdam circuits and on other circuits between Continental towns. The trial gave the operating administrations experience of this new method of operation and enabled them to iron out the operating and engineering difficulties before the new system was generally adopted.

To make a call to a United Kingdom subscriber the foreign operator dials the exchange routing digits (excluding the initial digit 0) appropriate to the United Kingdom national number, and the subscriber's number. Incoming register translators in the switching unit convert these digits into those required to route the call within the inland system.

A number of novel features have been incorporated in the new equipment to expedite the completion of calls.

For example, if the foreign operator has difficulty in completing the call satisfactorily after obtaining the required number, she can ring on the connexion to attract the attention of an operator in the London Continental exchange, who can speak to both foreign operator and the called subscriber to give whatever help is needed.

The language which the assistance operator must speak is shown by a special lamp.

If the wanted subscriber is on a manual exchange, the distant international operator is called over a circuit to the country concerned by operating a special key. The appropriate language is also indicated on these circuits. Other keys are operated to obtain connexion to designated positions that deal with suspended traffic.

By 1961 this unit should be handling the bulk of traffic between this country and Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Sweden and Switzerland.

Mr. Ronald Ernest German, C.M.G., whose retirement from the Postmaster Generalship of East Africa we recorded in our last issue, was honoured in the New Year list by being created Knight Bachelor.

In the February, 1953, *Journal* Mr. German described the telecommunication services in East Africa, where he became Postmaster General in 1950 after three years as an Assistant Secretary in the United Kingdom Post Office. While in East Africa he was a member of the Central Legislative Assembly and Chairman of Makerere College Council. He joined the Post Office in 1925 and became an Assistant Secretary in 1947, after three years' secondment to the Sudan.

One who worked with him in London recalls his outstanding ability as an administrator, "helped by a good power of decision, directness of approach, common sense, a capacity for hard work—and not too deep a concern for red tape".

Lifting a heavy manhole cover

Accident Prevention in the Engineering Department

L. F. Scantlebury,
A.C.G.I., D.I.C., M.I.E.E.

SO FAR AS CAN BE ASCERTAINED THE ACCIDENT rate and sick absence due to accidents of the minor engineering grades in the Post Office compare favourably with those of industry in general. However the fact that on an average every 100 engineering workmen can expect to incur at least four accidents a year and some 60 to 80 days' sick absence gives no grounds for complacency. To keep accident prevention constantly before management and staff it has recently been made a standing item on all Regional Engineering Whitley Committees.

To enable the Engineering Department to watch trends and take suitable action if any particular aspect of work should appear to be causing an undue proportion of accidents, all reported accidents which occur to engineering staff are classified under 14 different categories and a return made to the Engineering Department every third quarter showing the total number of accidents which occurred under each category during each quarter. Tables I and II show a summary of this return for the past five years.

Further, each quarter the case papers of every accident which has occurred during the quarter in two or three selected categories are sent to the Engineering Department. The cause of the accident is clearly established and schedules giving details of each of these accidents, and where necessary suggested action to prevent a repetition, are prepared for consideration by the Experimental Changes of Practice Committee. This last is a joint committee of staff and official representatives presided over by the Engineer-in-Chief.

In this way the Committee can closely scrutinise a large number of actual accidents in all categories over a period of some six or seven quarters. As a result changes in methods of working to eliminate unsafe practices are suggested and recommendations made for additional or improved mechanical aids and handling devices and for improved safety precautions when carrying out hazardous work.

Safety precautions and safe methods of working are laid down and fully described in Engineering Instructions but, in addition, a personal copy of a brief and concise epitome of the principal safety regulations, in the form of a small booklet of about 16 octavo sheets (known as Rg 41), is given to every member of the engineering staff. It is well illustrated with photographs and revised at frequent intervals. It is in the interest both of the man himself and of the Post Office that these safety regulations, the necessity for which has been proved by the experience of actual accidents, should be strictly observed.

The main danger to be guarded against in

manholes and cable tunnels is from ordinary coal gas finding its way in from faulty gas mains. This is dangerous in that, when present in quantities above about 1 per cent., it is poisonous. It is also inflammable and if present to over 7 per cent. will explode, because of its content of carbon monoxide. Underground structures which have been closed for some time are also found to contain foul air and atmospheres deficient in oxygen.

Considerable attention has been given to the problem of devising a simple and reliable means of detecting the presence of inflammable and asphyxiating gases in underground workings such as coal mines, sewers, tunnels and manholes, and a number of appliances has been devised. Some 25 years ago the Post Office Research Station at Dollis Hill designed and introduced the "Gas Leak Indicator No. 2" for detecting very small quantities of carbon monoxide.

The tester, of simple construction, as will be seen from Fig. 1 was based on the reaction between palladium chloride and carbon monoxide whereby metallic palladium is precipitated and thus darkens a test paper; the degree of darkening gives an indication of the carbon monoxide concentration. In recent years the palladium chloride solution has been superseded by sodium chlorpalladite which has been found to be more stable and easier to manufacture in bulk, and has a useful life of at least two years. The solution is contained in a small glass phial, similar to that used for iodine pencils, and bears a label giving the date of expiration of its useful life.

The tester contains suitable test papers enclosed between a base plate, and a face plate which has an aperture exposing the test paper between two reference buttons of special colours with which the colour of the test paper can be compared. In use the test paper exposed at the aperture is moistened by the phial and the tester placed for at least five minutes in the atmosphere to be tested. The tester is then withdrawn and the colour of the exposed

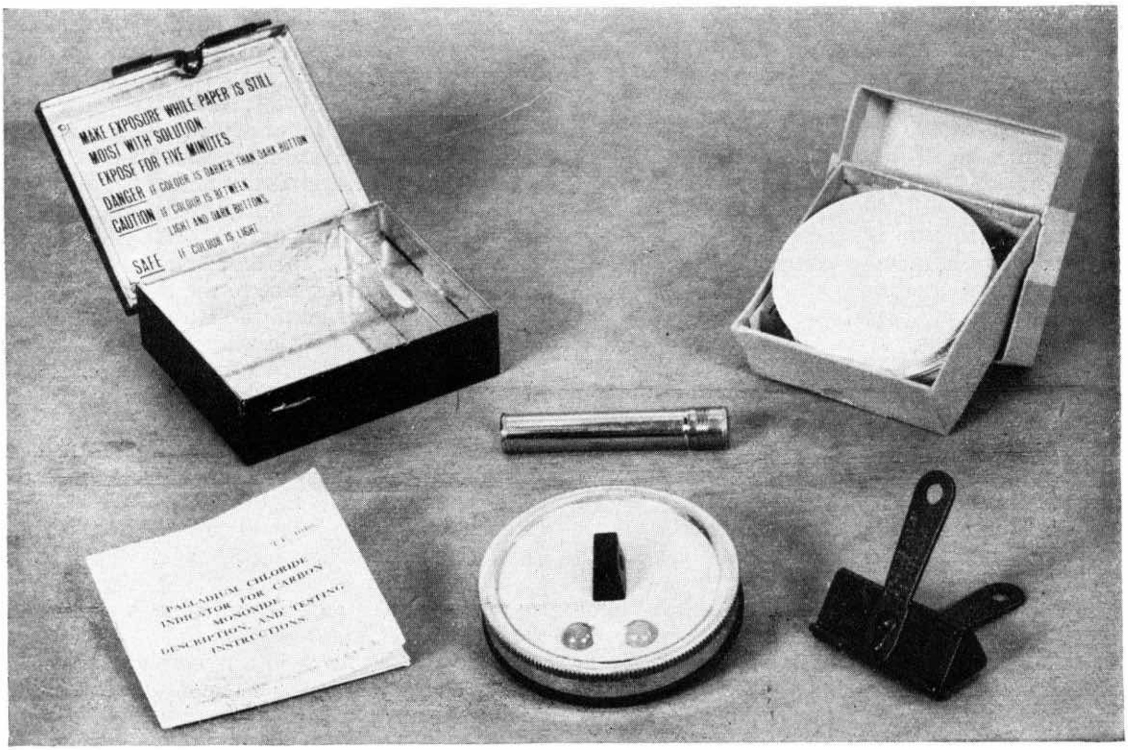


Fig. 1: Gas Leak Indicator No. 2

test paper compared with the reference buttons and the colour of the face plate. If the same colour as the face plate no carbon monoxide is present; if the same as the lighter button 0.05 per cent. of carbon monoxide is present, indicating a need for caution; if the same or darker than the darker button 0.10 per cent. or more of carbon monoxide is present. In this last case the atmosphere is dangerous and in no circumstances should work be undertaken.

To detect foul air and asphyxiating gases a safety lamp is used—"Lamp, Safety, No. 1A" shown in Fig. 2—which is an oil-burning miner's type safety lamp approved by the Coal Board for use in mines. Protection is provided by two concentric gauzes of woven steel and the lamp is also provided with a steel lock which prevents the steel bonnet from being unscrewed. The flame can be readily seen through clear glass. The presence of foul air or asphyxiating gases is indicated by diminution or extinction of the flame. It will be extinguished well below a dangerous concentration of gas.

Fig. 2: Safety Lamp, No. 1A

Before testing with the safety lamp a test to prove the absence of any explosive gas with the Gas Leak Indicator No. 2 must always be made. Despite these precautions some 15 or 20 explosions affecting Post Office staff or plant or both occur each year, but in only a small proportion of these is staff involved, as a number of explosions occur unaccountably when no men are working in the vicinity. These explosions are also the subject of scrutiny by the Experimental Changes of Practice Committee.

Occasionally inflammable gases are met which do not contain carbon monoxide, and which cannot therefore be detected by the Gas Leak Indicator No. 2. Propane burners, for example, are being introduced to replace jointers' petrol blowlamps. Butane and methane is also being used in some town gas supplies. A further tester is therefore available which will give an accurate indication of the concentration of any inflammable gas. As shown in Fig. 3 it is a more complicated device (and more expensive) than the simple Gas Leak Indicator No. 2.

This indicator, known as Gas Leak Indicator No. 3, contains a platinum filament which is heated and a sample of the gas to be tested is drawn over it by means of a sampling line and aspirator bulb. Any inflammable gas present burns on the surface of the filament and increases its temperature and electrical resistance. The resistance change can be measured and gives an indication of the amount of inflammable gas in the sample. The instrument is held at convenient centres so that it is readily available when concentrations of gas are suspected.

Work on Poles

Although all poles are pressure creosoted decay unfortunately occurs under certain conditions, and it is not always easy to detect, particularly if it is internal. The periodic testing of all poles more than seven years old has therefore been introduced on a 6-year cycle, the testing being carried out by experienced testers who have been specially trained.

The most satisfactory practical tests so far developed for discovering decay are the hammer test for internal decay and the probe test with a sharp pointed tool for apparent or suspected surface decay. Poles are tested from below the ground line to the tip, for decay is occasionally found only at the top and not elsewhere. Decay, however, principally occurs at the ground line and the soil is therefore removed to permit testing down to 12 inches below. Poles decayed beyond a certain specified amount are labelled "D" (decayed) and arrangements made for their early replacement. Those slightly decayed are labelled "S" (suspect) and are retested yearly. Some 3 per cent. of the poles tested are found to be "D" and another 3 per cent. "S". Staff are warned to take special precautions before working on poles labelled "D".

Such periodic tests do not however relieve a man in any way from the responsibility of making sure personally that a pole is safe before he starts work on it by testing for soundness, using the hammer and probe tests. All overhead training courses include such instructions.

Quarter Ended	No. of Minor Engineering Staff employed	No. of accidents occurring during the quarter involving sick absence	Percentage of accidents to staff employed	No. of days absence incurred during the quarter
30. 6.53	59,751	605	1.01	11,352
31. 3.54	61,141	689	1.12	12,587
31.12.54	60,133	628	1.04	11,152
30. 9.55	64,732	702	1.08	12,645
30. 6.56	67,672	721	1.07	10,050
31. 3.57	70,570	847	1.20	14,502
31.12.57	70,626	743	1.07	13,455
30. 9.58	69,673	696	1.00	11,729

Table I. Return of Accidents on Duty—Minor Engineering Grades

The most important item of an overhead man's equipment is his safety belt which is a personal issue to him. He is expected to keep it in good condition and to change it should it become in any way defective. It is in his interest not only to maintain his belt in a sound condition but also to use it in the correct manner.

As will be seen from Fig. 4 the belt consists of two parts, an inner belt which is buckled around the waist and a larger outer belt which encircles the pole or other suitable firm fixture to prevent the man from falling. Two safety slides are provided, one with two slots and the other with three. The two slot slide is attached to the outer belt by passing it through one of the slots and is prevented from being removed by a leather stud. After passing round the pole and buckling, the outer belt is slipped into the second slot, the end of which is open, and the slide pushed up close to the pole as shown.

Quarter ended	Traffic incl. Dept's. vehicles, hand-carts, etc. (a)	Starting up motor vehicles (b)	Men falling from trees, poles, ladders, roofs etc. (c)	Poles, ladders, etc. falling and slipping (d)	Lifting loading, unloading and carrying poles and ladders (e)	Tree cutting Operations except (c) (f)	Lifting box and manhole covers (g)	Wire and metal dust in eyes men struck by end of wire (h)	Injury caused by use of tools (spades, spanners pliers etc). (i)	Apparatus falling on men (j)	Cut hands when engaged in operations (k)	Burns while plumbing and soldering (l)	Slipping (on roads, stairs; from lorries etc). (m)	Misc. (n)	Total
30.6.53	13	6	37	38	58	11	28	34	45	37	41	22	83	152	605
31.3.54	12	10	53	61	53	15	23	37	61	28	32	9	121	174	689
31.12.54	28	12	60	43	56	10	16	22	52	34	32	6	87	167	625
30.9.55	18	6	44	41	60	9	27	38	71	37	37	9	90	215	702
30.6.56	22	5	49	72	71	14	23	33	59	59	53	11	97	153	721
31.3.57	16	8	51	49	64	10	31	42	57	64	43	15	141	256	847
31.12.57	25	10	45	39	93	15	38	39	54	68	56	15	103	143	743
30.9.58	22	6	41	41	68	6	30	28	42	42	43	18	95	214	696

Table II. Return of Accidents on Duty—Categories

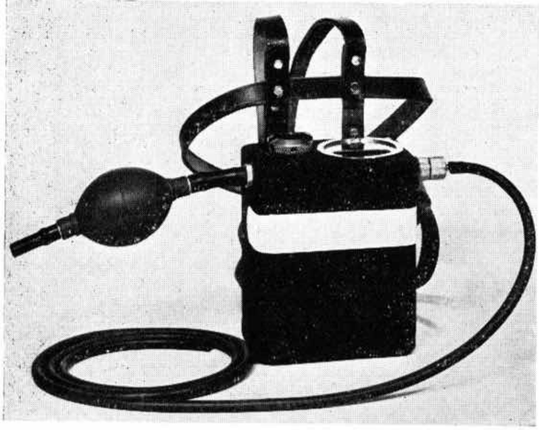


Fig. 3 : Gas Leak Indicator No. 3

Should the outer belt break between the slide and its connexion to the inner belt the broken end has to slip through the slide before the man can fall and therefore gives him a chance to save himself. The three slot slide is attached to the short buckle end of the outer belt. After being fastened at the buckle the free end of the outer belt is passed through the centre slot and back through the outer slot. This safeguards against a failure of the buckle.

The belt must of course be fastened to a firm support, preferably the pole itself and not to brackets, insulator spikes, or similar fixtures liable to give way.

Ladders

Ladders are a frequent cause of accidents usually because of carelessness and failure to observe a few elementary precautions which have been laid down. A ladder should always be erected at a moderately steep angle with its base firmly on the ground and the top against a strong rigid support. If the ground is slippery or uneven, or there is a danger of the ladder moving the top should be lashed (Fig. 5). Ladders should not be used on polished floors unless every precaution has been taken to ensure the base will not slip, and any borrowed on site from subscribers or contractors should be closely inspected before use.

A supervising officer inspects every ladder about every two years for defects such as cracked, decayed, or loose rungs, and for loose or badly worn fittings. Every ladder is tested by supporting it horizontally at its ends and applying a load of 180 lb. at its mid-point. A ladder under such conditions should not deflect unduly, creak or give any evidence of incipient weakness.

If there is any doubt a further load of 20 lb. is added. This test imposes a stress on the ladder about four times greater than would occur when it is used at its normal working angle.

The life of a ladder can be considerably shortened by careless storing when not in use and ladders should be stored under cover and supported at at least 10-foot intervals. Wooden ladders should be kept away from hot water pipes and heat which would rapidly cause the timber to become dry and brittle.

Manual Handling

Clearly, work cannot be arranged so that in no circumstances will a man ever have to lift a heavy weight. There will always be times when a pole will have to be manhandled, a heavy manhole cover lifted, or a heavy box or sack shouldered. At least a fifth of all the recorded accidents to engineering staff are probably caused by lifting and loading heavy or awkward loads; in addition, a high proportion of sickness also arises from the after effects of strains which have not been associated with any reportable accident.

Two main types of strain affect the human body. The first, and most common, type met with is usually caused by lifting or attempting to lift a heavy object in the wrong manner. The second type of strain develops because constant tension in the muscles over a period of time results in the muscles losing their elasticity, and injury may result later even though no great exertion was being made at the time.

Methods of exerting muscular effort are very often haphazard and little attention is given to the proper approach. Those that appear to be the most comfortable and natural when lifting are very often the wrong methods and may have developed through force of habit or through seeing others doing the same thing.

Much can be done to eliminate accidents and strains caused by lifting by training staff in correct methods. Investigations in human kinetics have evolved certain principles which have been accepted and are being publicised by the Industrial Welfare Society so that industry generally is becoming increasingly alive to the importance of this matter.

In brief, the basic principles to be followed are:—

(*a*) Proper hold. The hands must have a comfortable and secure hold, the palm being used as much as possible and concentration of pressure on the finger tips avoided.

(*b*) Keep a straight back. A bent back is always a weak one.

(*c*) Chin in. Raising the top of the head and tucking the chin in straightens the whole spine, automatically raises the chest and conditions the shoulders for more efficient arm action.

(*d*) Foot position. The feet must be placed on the ground in a secure position to produce a good balance. Wrongly placed feet undermine all physical effort and form one of the most common causes of straining and injury. The majority of handling movements should be performed with one foot placed in advance of the other to improve balance; the body weight is then used to the best advantage.

(*e*) Arms to body. Working with the arms out from the body puts an excessive load on the arms, shoulders, back and should be avoided whenever possible. When lifting or carrying, the arms should be as near the body and as straight as possible.

(*f*) Use of body-weight. Proper placing of the feet and relaxation of the knees allow the body-weight to be naturally transferred from one foot to the other as required. In this way the body-weight plays an important part in overcoming resistance to movement, and reduces the amount of muscular effort necessary. Probably the most common mistake in this respect arises from the desire to feel comfortable at the beginning of a movement. When properly placed to employ body-weight effectively, the starting position is often uncomfortable, especially so when an attempt is made to hold the position without moving.

The above principles are illustrated on page 72 which shows the advantage of two lifters placing their foreheads together.

The Engineering Department has produced an Instruction which amplifies these basic principles

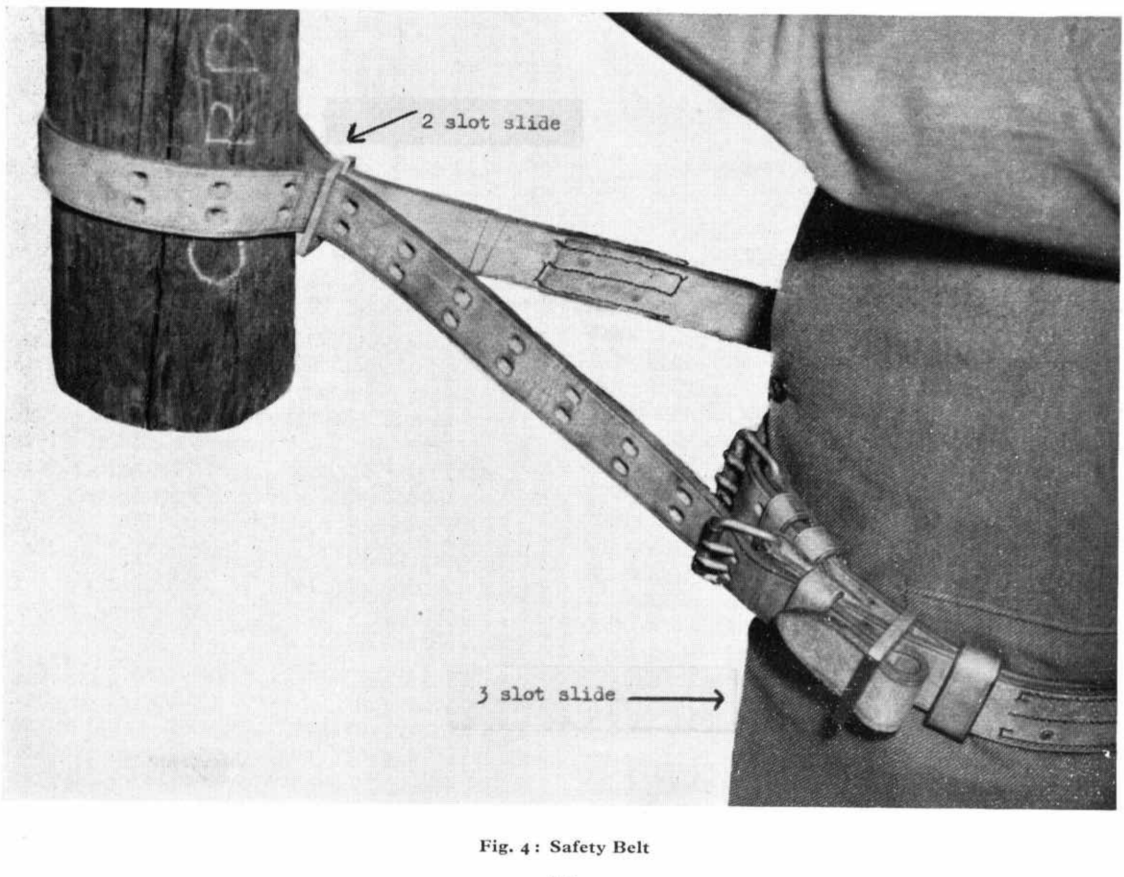


Fig. 4: Safety Belt

Fig. 5: Extension Ladder lashed to pole

and shows how they should be applied to the handling of poles, cable drums, manhole frames and covers, and other heavy items of equipment.

In addition selected instructors from Regional Training Schools have attended a week's instruction course run by the Central Council for Physical Recreation, so that they can impart the instruction to students at the Training Schools. Instruction is also being given to teams from each Telephone Area so that they can also give individual tuition to every external man. Films are being prepared.

Safety precautions are of no use unless they are carried out and if every member of the staff would take the trouble to absorb and strictly follow the safety regulations prescribed for his duties the number of accidents would quickly fall. Too often however the safety regulations seem to be regarded as Departmental "fussiness" or are not followed simply because other ways seem easier. Education into the need to be careful and alive to risks, is therefore as necessary as is instruction about the appliances etc., available and their method of use, and a by no means insignificant line of approach for the Regional Engineering Whitley Committees.

Royal Corps of Signals

14,000 Post Office men served in the Royal Corps of Signals during World War II. In *The Royal Corps of Signals: a History of its Antecedents and Development* (Royal Signals Institution, 30s), Major-General R. F. H. Nalder shows how they were thus continuing an association now nearly 90 years old.

The Royal Engineers formed a telegraph detachment for the Abyssinian War in 1868. Next year, the War Office established a Signal Wing which included an Instructor in Telegraphy. When the Post Office took over inland telegraphs in 1870, R.E. sappers were lent to mitigate the shortage of civilian technicians, thus acquiring a pool of trained telegraphists as a reserve for war. The sappers remained at the Post Office until World War I.

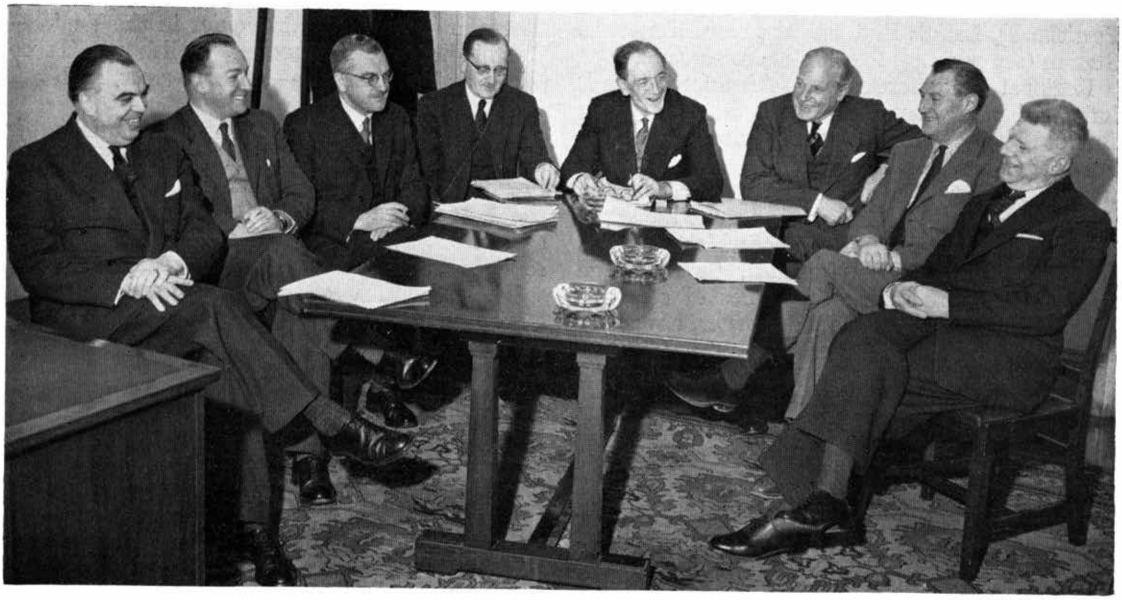
The Royal Engineer Telegraph Corps was formed in 1884 but was renamed Telegraph Battalion, Royal Engineers, two months later. Many men, and boys of sixteen, were recruited from the Post Office. A body of Post Office volunteers was formed; the men took annual training at Aldershot and "gave valuable service" during the Egyptian campaigns, the South African War and the Great War. In June 1920, a Royal Warrant under the signature of Winston Churchill, then Secretary of State for War, established the Corps of Signals; in August of the same year King George V gave it the "high honour of the title Royal". The Corps was mechanized in 1936-37.

Sir Stanley Angwin, then Engineer-in-Chief of the Post Office, and Deputy Chief Signal Officer, Supplementary Reserve—he had become Brevet-Colonel in 1922—helped in preparations for the coming war, lending wireless equipment and suggesting the England-Jersey-France cables to provide alternative routes to the Straits of Dover cables.

The present Engineer-in-Chief, Brigadier Sir Lionel Harris, served in Signals throughout the war, becoming Chief of Telecommunications, Signals Division, SHAEF, in 1944-45.

General Nalder traces the development of army signalling equipment from the single needle type transmitter used in the Crimea, 1854-55 to the conversion of the Army Chain to teleprinter working and the institution of tape relay, the use of VHF wireless sets, and modern telephone switchboards for major Headquarters and Lines of Communication.

The Post Office in the South West



The Regional Board (left to right): Mr. F. J. HART, Public Relations Officer; Mr. R. B. BAILEY, Staff Controller; Mr. C. E. MOFFATT, Chief Regional Engineer; Mr. W. H. PENNY, Deputy Regional Director; Mr. L. G. SEMPLE, C.B.E., Regional Director; Mr. G. H. FARNES, Telecommunications Controller; Mr. F. W. LISTER, Postal Controller; Mr. J. L. HERLIHY, Finance Officer

THE SOUTH WESTERN REGION OF THE POST Office covers 10,000 square miles stretching from Berkshire to Land's End, from the Wye Valley to Southampton, and includes the Scilly Isles, 36 miles across the strait between the Atlantic Ocean and the English Channel. The Region serves some 4,000,000 people, and half as many again holiday makers demand services during the summer. The visitors cause considerable rise in postal traffic, and trunk telephone evening calls in the Region as a whole are 50 per cent. higher—and more than double at many exchanges—during the summer.

Most of the Region's boundaries are coastal, from the Bristol Channel to Land's End in the north and west, and as far east as the Solent in the south. The landward boundary runs from the Wye Valley on the Gloucestershire border in the north, across the Severn near Tewkesbury to the Vale of Evesham and southward along the Gloucestershire–Oxfordshire boundary, across the Berkshire and Wiltshire downs to Hampshire.

The Region controls the postal services in the Channel Islands. Jersey and Guernsey operate their own telephone services under licence, and they are linked with the mainland by cables terminating near Dartmouth and—a new cable opened only last September—near Bournemouth. A cable with the Scilly Islands (which are also linked by radio) terminates at Porthcurno near Land's End in Cornwall.

The cables with the Channel Islands and the Scillies are part of this country's inland telephone service, but many oversea cables terminate within the Region. Eleven Cable & Wireless Ltd. cables connecting Britain with the oversea Commonwealth and foreign countries terminate at the Company's Porthcurno Station. Two American companies' cables also make landfall within the Region: Western Union's at Sennen Cove on the other side of Land's End from Porthcurno, and the Commercial Cable Company's at Weston-Super-Mare. Traffic to and from all these cables is carried across the country by Post Office land-lines which traverse the Region.

The Post Office also has six radio stations in the

South Western Region; Bodmin, Dorchester and Somerton for oversea telegraphy and telephony, and Burnham (with its associated station at Portishead), Land's End, and the new Ilfracombe Station (see page 49) for ship-shore services.

Regional Headquarters are at Bristol, the largest industrial and commercial city in the West; Bristol Docks, with those of Avonmouth and Portishead, handle about 10 million tons of oversea trade every year. The postal services are operated through 62 Head Postmasters and there are seven Telephone Managers' Areas, six of which—Bristol, Bournemouth, Exeter, Plymouth, Southampton and Taunton—share the 600 miles of coastline between them; the seventh, Gloucester, has access to the sea by the Severn Estuary.

Southampton, at the south-east corner of the Region, is the home of the biggest ships afloat. Half of all Britain's ocean passengers pass through the port; more than 22 million tons of shipping—a record—used the docks in 1958. Fawley Refinery on Southampton water is the largest in the Commonwealth, handling a quarter of a billion tons of oil a year—a third of the United Kingdom's total imports.

Among other South Western Region cities and towns, Plymouth and Portland are seaports traditionally associated with the Royal Navy. There are seven cathedral cities in the Region—Bristol, Exeter, Gloucester, Salisbury, Truro, Wells and Winchester—and two spas, Bath and Cheltenham.

Beyond the cities dairy farming, flourishing in the south west climate and on its soil, is the predominant industry; productivity is high and the Post Office has helped communications for agriculture since the war by extending telephone services for farmers in undeveloped areas.

The Region was serving 591,000 telephone stations by the end of 1957-58—more than twice as many as in 1938-39. Of the 792 telephone exchanges, 651 are automatic.

In recent times the Post Office has especially linked Bristol with several of its own developments: the first Central Battery exchange in Europe, the introduction of 2VF dialling—and the inauguration of Subscriber Trunk Dialling at Bristol Central Exchange by Her Majesty the Queen on December 5, reported on pages 48 and 49 of this issue.

Telecommunications Statistics

	Quarter ended 30th September, 1958	*Quarter ended 30th June 1958*	*Quarter ended 30th September 1957*
Telegraph Service			
Inland telegrams (excluding Press and Railway) ...	3,749,000	3,349,000	4,118,000
Greetings telegrams	888,000	752,000	669,000
Telephone Service			
Gross demand	94,737	88,753	74,136
Connexions supplied	83,157	83,820	75,870
Outstanding applications	157,375	160,216	184,364
Total working connexions	4,537,000	4,516,285	4,481,856
Shared service connexions	1,141,383	1,147,296	1,153,115
Total inland trunk calls	87,814,619	82,318,593	80,473.000
Cheap rate trunk calls...	22,400,085	18,738,521	17,380,000
Telex Service			
Total working lines	4,595	4,448	4,159
Total inland calls	830,000	818,000	728,000
Total overseas calls	468,000	444,000	419,000
Staff			
Telegraphists (including staff employed on Telex)...	5,461	5,939	5,879
Telephonists	45,511	45,235	44,649
Engineering workmen	64,092	63,551	64,501

National Telephone Numbers

R. W. Chandler

THERE HAVE BEEN SEVERAL ARTICLES ON Subscriber Trunk Dialling and related matters in recent issues of the *Journal*. Some have referred to national telephone numbers and their place in the STD system. The present article describes the national numbering scheme in more detail and outlines the main stages of development through which it has passed to reach its present form.

Why National Numbers are Necessary

The basic idea of a national numbering scheme is that each subscriber has a national telephone number which can be used to dial calls to him from whatever part of the country the call is made. Eventually, the same number, with a suitable prefix, will also be used for dialling calls to him from subscribers in other countries.

Subscriber Trunk Dialling could be run without a national numbering scheme; each subscriber could be given a list of the codes to be dialled from his exchange to call distant exchanges, the codes being selected so that the apparatus at his exchange could use them as dialled to steer calls through the switches to the appropriate trunk routes and charge for them at the correct rates. This would be little more than an extension of the present arrangements for dialling and metering calls between nearby exchanges.

Such a system would be very cumbrous because the codes would differ from exchange to exchange; they would have to be altered from time to time as the system grew and trunk routings or charges were changed; subscribers could not publish national telephone numbers on their stationery or in advertisements and this would be a handicap to users; the task of supplying each subscriber with code dialling lists applicable to his exchange, and of keeping them up-to-date as the system grew or codes were changed, would become more and more complex and costly. For these reasons we have adopted a national telephone numbering system.

When a national telephone number is dialled the exchange apparatus must do three things, and a national number must consist of three corresponding parts: first, a code to indicate that a trunk call is being dialled so that the call can be steered to the special equipment dealing with trunk calls; secondly, a code to identify the distant exchange, from which the trunk dialling equipment can select the trunk route to be used and the rate of charge to be applied; and finally the local number on the distant exchange to ensure the connexion of the call to that number.

General Principles

For the system to be economic the trunk dialling equipment must be able to determine both routing and charging without making an unduly complicated analysis of the exchange code portion of a national number. Also, to keep costs down and to make dialling as easy as possible, a national number must contain the fewest possible digits consistent with retaining an adequate capacity within the system for future growth.

There are about 6,000 exchanges in the country and the number may grow in time to about 8,000. To identify each exchange separately the generality of exchange codes must contain at least four digits.

For routing and charging, however, the trunk dialling equipment need not necessarily analyse all the digits in the exchange code. Usually, direct trunk routes are provided only between selected main exchanges known as group centres. These exchanges are the collecting and distributing centres for the trunk traffic to and from the exchanges they serve. There are fewer than 1,000 of these exchanges, and each can be identified by a three digit code.

If an exchange code is selected so that the first three digits consist of the code of the appropriate group, an analysis of these three digits at the originating or an intermediate exchange will suffice for routing trunk calls as far as the distant group

centre, at which point the remaining digits in the exchange code can be analysed, if necessary, to route the call to the required exchange.

To be of real value in simplifying the trunk dialling equipment the group codes must also indicate the rates of charge. This implies that trunk calls to all the exchanges in a group must be charged at the same rate. The group charging system now in operation, described by Mr. Longley ("Simplified Charges") in the Winter (February) 1958 issue, is based on this simple concept. The system, announced in November 1947 was introduced on January 1 last year.

Alternative Schemes Considered

The national numbering scheme for this country was evolved in the course of studies extending over several years, during which a number of interesting alternatives was considered. It may be of interest to outline their main features and the reasons for rejecting them.

The first system considered in detail would have provided group routing and charging on long distance trunk calls only, thereby permitting the use of "three-digit" trunk dialling equipment for routing and charging calls to not more than 1,000 distant groups. It was doubted whether the public would accept group charging on short distance trunk calls, and it was assumed that point-to-point (exchange to exchange) charging up to 30 miles would have to be retained. This called for a second, short range, set of trunk dialling equipment, which would also be of the three-digit code type as there would always be fewer than 1,000 exchanges to be separately identified for routing and charging purposes within such a small area.

The numbering system required for this scheme contained a number of interesting features. To make a long distance call a prefix—say O—would have to be dialled to gain access to the long-range dialling equipment. The exchange code, containing five digits, would then be dialled, followed by the local number. The first three digits would enable a call to be routed to a sub-division of the country, a charging group, and to be charged for at the rate applicable to the group. The fourth and fifth digits of the exchange code would identify the required exchange in the distant group but would not need to be analysed at the originating exchange.

For a short distance call a different prefix—say '1'—would be dialled to obtain short range trunk dialling equipment, followed by the third, fourth and fifth digits of the exchange code (selected to avoid repetition within 30 miles) and the local number.

Typical dialling procedures would be: *for a call to Watford* 9876: subscribers on Watford would dial 9876; subscribers within short dialling range would dial, say, 1 672 9876; subscribers elsewhere would dial, say, 0 39 672 9876.

The need for two trunk dialling procedures was regarded as a serious drawback.

A variation of this scheme, designed to help subscribers, was worked out. Each charging group would have had a district name which would eventually replace all existing exchange names in the area. For example, the Dover area might be called Channel, and the first two letters (CH) used as the initial digits of the codes of each exchange in the area. The national number of, say, Deal 9876, might then be CH 395 9876.

The directory entry of Deal 9876 would become CHannel 395 9876; subscribers on Deal would dial 9876; subscribers within short dialling range would dial 1 395 9876: subscribers elsewhere would dial O CH 395 9876.

This arrangement would have avoided long range code dialling lists as all necessary information could be in the directory entries and the short range dialling list could have been reduced to the names of groups within short range access. The main drawback was the need to abolish local exchange names.

Developments in electronics then opened the possibility of using a single-procedure trunk dialling scheme employing four-digit (10,000 code) electronic equipment which would enable point-to-point charging to be retained on all calls.

With this scheme a typical national number would be say: 0 5623 9876 where '0' is the trunk prefix code; 5623 exchange code; 9876 local number.

The conclusion was reached, however, that the scheme would be too costly for national use because of the complexity of the 10,000 code equipment and because such equipment would be necessary at every exchange.

Finally, consideration turned to the possibility of simplifying the single-procedure scheme by applying group charging to both short and long distance trunk calls. Not only would this permit the use of three-digit (1,000 code) in place of four-digit (10,000 code) equipment for both routing and charging but—a factor of equal importance—it would facilitate concentration of trunk dialling equipment at a central exchange in each group. It

was clearly established that, with suitable tariff adjustments, group charging could be applied not only to all trunk calls but also, and with advantage, to all local calls as well. From that point there was rapid progress in settling the broad outline of the national numbering system and tariff principles for the STD system for this country.

Scheme Being Used

The three basic parts of a national number for the approved STD scheme are :—

(1) The prefix code—O has been selected for the purpose—which steers a trunk call to the Group Routing and Charging Equipment (GRACE for short).
(2) The exchange code—the first digits of which also identify the routing and charging group in which the exchange is situated.
(3) The local number.

A national number may contain eight, nine or ten digits. This flexibility is necessary so that local numbering schemes may be planned economically and yet be capable of expansion later without involving changes in published exchange codes.

To permit this variation in the length of a national number the register-translators which form part of GRACE are designed to release themselves from a call if a ninth or tenth digit is not received within four seconds of the previous digit. This means that if subscribers pause unduly before dialling the last one or two digits of a national number of more than eight digits the attempt will fail and the call will have to be re-dialled. The delay period of four seconds was chosen to minimise trouble from this cause without introducing too great delay in the time required to complete the setting up of calls.

National Numbers in Non-Director Areas—

The following table (the figures in the three middle columns are only illustrative) shows the possible arrangements of national numbers in non-director areas.

National number				Total digits
Prefix	Group code	Code identifying exchange in group	Local number	
O	234	Exchange identified by group code alone.	987654	10
O	345		98765	9
O	456		9876	8
O	567	8	98765	10
O	678	8	9876	9
O	789	8	987	8
O	890	82	9876	10
O	901	83	987	9

About 720 codes are needed to identify the 633 non-director charging groups which have been established. Some groups need more than one code: for example, it is sometimes desirable to have one code for the group centre exchange and another for the other exchanges in the group, to simplify the switching arrangements at the group centre exchange. In other groups two codes are necessary to route incoming trunk calls for some of the exchanges to a different centre from that which serves the remainder of the exchanges.

—and Director Areas

In director areas a local number consists of the first three letters of the exchange name and a four-figure number, or seven digits altogether. A national number cannot contain more than 10 digits; therefore, the group code for a director area cannot exceed two digits. Even a two-digit code was considered too long for London, to which a high proportion of trunk traffic is directed, and for subscribers' convenience a single digit code was adopted for this area.

Capacity of the Scheme

The short codes for London and the five provincial director areas together are equivalent to 150 standard "non-director" group codes, thereby reducing the number of three-digit codes available for use in non-director areas to 850. This still leaves a reasonable margin as only about 720 are needed for immediate use in the non-director areas, and once the scheme has been laid out it will cover the whole country and there is little prospect of additional codes being required in future.

Within a group the numbering scheme provides for a maximum of six figures in local numbers which, even allowing for various losses, can accommodate more than 500,000 subscribers' numbers. The largest non-director group (Leeds) at present contains only about 50,000 subscribers so there is ample margin within the numbering scheme to meet any conceivable future developments in these areas. The national numbering scheme as a whole is in fact expected to have a

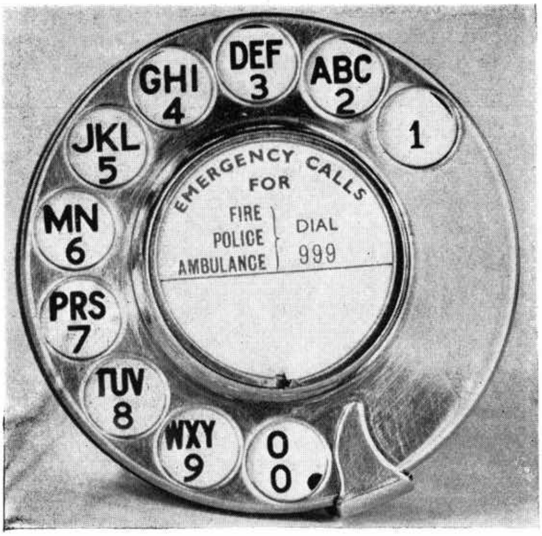


Fig. 1 : The Dial : letters in black, figures red

reasonable chance of meeting all needs for the next hundred years.

Letters in National Numbers

The letters and figures of telephone numbers in director areas will form the "local number" part of the national numbers of subscribers in these areas. This means that all subscribers in STD areas must have lettered dials fitted to their telephones so that they can dial calls to director areas. This opens the possibility, already referred to, of including letters in all national numbers. The codes for non-director groups are received by register-translators and translated for switching and routing. This gives considerable freedom in their allocation and so permits extensive use of letter codes derived from exchange names.

Letter codes are unquestionably popular with the public. Experience in the director areas shows that they help subscribers to remember what would otherwise be seven-figure numbers and to dial accurately by reducing, for example, the risk of transposing digits in a long string of figures. Letters take a trifle longer to dial than figures, doubtless because they are not so readily found on the dial, but this may itself conduce to dialling accuracy.

In the Autumn 1957 *Journal* Dr. Conrad and Barbara Hille ("Memory for Long Telephone Numbers") wrote that "... groups of letters which are abbreviations of place names (that is symbols with meaning) are valuable memory aids."

Effect of Letters on Code Capacity

A disadvantage of using letters in national numbers arises from the fact that there are no letters against the figure 1 on the dial (see Fig. 1). Hence the number of letter codes which can be produced is less than the number of figure codes. For example, if one of the digits in the three digit group codes is a letter there are 900 possible codes instead of the 1,000 available if all three digits are figures; if two are letters, 810; and if all three are letters, 729. Only 720 codes are required for non-director groups in this country so, if the director area group codes are suitably chosen to avoid encroachment one or two letters can be used in the codes for the non-director groups and still retain a sufficient margin of spares.

With all this in mind it was decided that two letters should be used in the codes of non-director groups, and that these letters should, as far as possible, be the first two of the names of the groups.

Position of Letters and Figures in the Codes

There were two choices for the position of the letters in the group codes: a figure followed by two letters or two letters followed by a figure. The former had the advantage that the figure could have a geographical significance which might help subscribers to remember codes; for example, all national numbers in south-west England could start with 04 (0 being the prefix and 4 the regional digit) producing STD codes such as 04 BR for Bristol.

The advantages of placing the letters first and dropping the geographical significance of the figures were greater flexibility in using letter codes, more letter codes available (losses from the use of a short London code could be avoided), and simpler codes for the smaller exchanges which require one or two additional figures after the group code to identify them: for example, OLE 382 rather than 03 LE 82. It was therefore decided that the letters should precede the figures in the group codes and that for publication the prefix O should always be included in group codes. This led to the adoption of codes of the form OBR 2 (for Bristol) as standard for most non-director groups.

Codes for Director Groups

To avoid encroaching on the letter codes available for allocation to non-director groups the

director area codes all include 1 which has no letter equivalent. They are:—

	Code including prefix	Typical national number	
London	01	01 CEN	2345
Birmingham	021	021 MID	2345
Edinburgh	031	031 WAV	2345
Glasgow	041	041 CLY	2345
Liverpool	051	051 AIN	2345
Manchester	061	061 DEA	2345

The intermediate digits in the provincial codes have been allocated in sequence according to the alphabetical order of the names. Readers may be interested to detect a further connexion which may later be publicised.

Codes for Non-Director Groups

A total of 810 codes consisting of two letters followed by a figure is available to meet a total requirement of about 720. The standard code includes the first two letters of the name of the group, but certain first-two-letter combinations occur much more frequently in place names than do others. For example, combinations equivalent to 22 on the dial (ABC/ABC) occur very frequently in names such as ABerdeen, BAth, CAnterbury and so on, whereas others, such as 66 (MN/MN), do not occur at all. Only 10 groups can have codes beginning with the same first two letters or their dial equivalents, and this has been found to limit to about 600 the number which can have codes including the first two letters of their names, even allowing for the use of some not entirely satisfactory names.

Instead of using first-two-letter codes for these groups and an entirely different form of code for the remainder it is now proposed to make somewhat less extensive use of first-two-letter codes and to use the extra elbow room thereby gained to give significant letter codes to most if not all other groups. These "significant" codes will consist of the first and one other letter. At the time of writing it seems that first-two-letter or good significant codes can be used, derived from satisfactory group names for all but 30 very small groups, mainly in Scotland.

In certain instances "significant" rather than "first-two-letter" codes may be adopted, even when the latter would be possible. Thus, for many two-word names codes consisting of the first letter of each word can be used; for example, MH for Market Harborough rather than MA, which is less distinctive. Also, the use of the letter I as the second letter of a code is being avoided as there is a risk of its being mistaken for the figure 1 when used in this position; for example, the code for Lincoln would be LC rather than LI.

Selection of Names for Non-Director Groups

The selection of names for groups is a complicated problem. Not only must the names be suitable in themselves but they must permit the derivation of letter codes which can be fitted into the coding scheme. Many groups are centred on large towns and are clearly identified by these town names. Others are in predominantly rural areas for which district or county names are better than place names. For many groups there are equally good alternative names and where this is so the names chosen will be the most convenient from the coding point of view.

As already mentioned, it seems likely that only a few remote groups will be unable to receive significant letter codes derived from acceptable names, and even in those groups a solution may be found.

Consider, for example, the Shetland Islands, which comprise six charging groups but have very few telephone connexions. Each of these groups cannot have a good significant letter code of standard form, as these are needed for larger groups elsewhere. On the other hand, one code including the letters SH could be found for the Islands as a whole. Suppose this code is OSH 8; each charging group in Shetland could have a code of the form OSH 82, OSH 83 and so on.

All calls to Shetland from the mainland are routed via Lerwick and all are chargeable at the maximum rate under STD conditions. Therefore, register-translators on the mainland could still route and charge calls to all the Shetland Islands by identifying the code OSH 8. For STD calls within the Shetland Islands the register-translators would need to identify the next digit in each group code, but the standard register-translators already include provision for a limited amount of this sort of identification. Such an arrangement cannot be used widely without introducing undesirable complications in the STD plan, but it may be possible to use it on the small scale necessary to clear the remaining coding difficulties. If not, arbitrary

letter codes will have to be used for these outlying groups.

Selection of Figures in Group Codes

The final figure in the group codes will be chosen according to the sizes of the groups, the rule being the larger the group the smaller the figure. Exceptionally, the figure 1 will be avoided where the third letter of the group name is I lest it lead to dialling errors; for example, OBR 2 is being used for Bristol rather than OBR 1, which might be mistaken for OBR I. As a further precaution against dialling errors the figure 1 will be used only where there will be at least one other figure in the code of every exchange in the group concerned, so that the codes can be published as, for example, OAB 17. This condition will arise in many groups; for example, those served by a switching centre outside the group.

The figures added to group codes to identify individual exchanges will be determined by the design of the switching equipment at the group switching centres. Fig. 2 illustrates the exchange codes derived in typical groups by application of the principles described above.

Presentation of Codes to Subscribers

All exchanges will retain their present names, but where appropriate, the entries in trunk code dialling lists may include the group's name after the exchange name. This will indicate the derivation of the dialling codes and implies that the group's name must be suitable for use in this way.

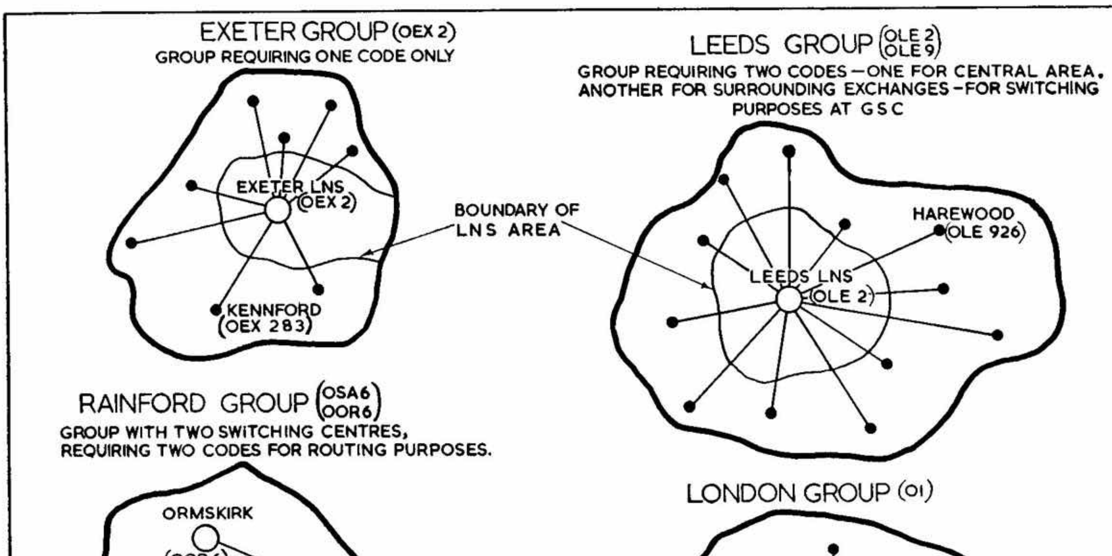


Fig. 2 : Exchange codes in Typical Groups

TRUNK DIALLING CODES

GENERAL

To call a subscriber on the list below, dial the code; then the subscriber's number.

e.g., for Chester **24600**
dial **OCH 4** **24600**

RATE OF CHARGE		CODE	RATE OF CHARGE		CODE
c	Beeston (Nottingham)	**ONO 2**	*c*	LONDON see pages 8 and 9	
c	BIRMINGHAM see page 10		*c*	Low Fell (Newcastle)	**ONE 2**
a	Bridgwater	**OBR 8**	*c*	MANCHESTER see page 14	
c	Brighton	**OBR 3**	*c*	Newcastle-on-Tyne	**ONE 2**
	also Hove			*also* Dunston	
				Felling	
c	Bulwell (Nottingham)	**ONO 2**		Gateshead	
a	Cardiff	**OCA 2**		Gosforth	
	also Penarth			Hebburn	
c	Chester	**OCH 4**		Jarrow	
a	Chippenham (Wilts.)	**OCH 9**		Lemington	
				Low Fell	
c	Cleethorpes (Grimsby)	**OGR 2**		Wallsend	
c	Dunston (Newcastle)	**ONE 2**		Whickham	
a	Dursley	**ODU 8**			
			a	Newport (Mon.)	**ONE 3**
c	EDINBURGH see page 11		*c*	Nottingham	**ONO 2**

Fig. 3: Extract from Bristol Trunk Dialling Booklet

The following (for illustration only) are possible forms of entry in trunk code dialling lists:

Brighton	OBR 3
Dewsbury (Wakefield)	OWA 62
Galashiels (Tweed)	OTW 5
Penn (High Wycombe)	OHW 12
Port Talbot (Glamorgan)	OGG 52

Fig. 3 is an extract from the special Trunk Dialling Code Booklet issued to subscribers in the Bristol Central exchange area for the introduction of STD last December. Booklets of this type will probably be issued for some years to come at all centres where STD is introduced. We can, however, look forward later to the issue of a common list of trunk dialling codes to all exchanges in the country with STD, or even to the abolition of such lists altogether and the publication of telephone numbers in their national form.

Conclusion

I have not been able to mention all the details which have had to be considered in planning the national numbering scheme, but this outline may be sufficient to make clear the considerable effort which has been put into devising a system which is attractive, easy to use, and capable of meeting any conceivable future developments of the telephone system in this country. Those concerned with the operation are confident that time will prove their efforts to have been worthwhile. The success with which subscribers at Bristol are using the new trunk dialling codes is a good omen.

Post Office Studies American "DDD"

Mr. F. I. Ray, Director of the Inland Telecommunications Department and Chairman of the *Journal* Editorial Board, led a Post Office party to the United States to study the American telephone system, particularly in respect of the development of, and public reaction to, DDD (Direct Distance Dialling) the American equivalent of STD.

With Mr. Ray were Miss Nan Whitelaw, Assistant Secretary, Telephone and Telegraph, Union of Post Office Workers; Miss C. N. Hampton, Supervisor, Welbeck Exchange and a member of the Association of Post Office Controlling Officers Executive Council; Mr. L. Hill, Staff Controller London Telecommunications Region; and, as Secretary, Mr. J. M. Harper, Principal, ITD.

The Postmaster General was so impressed by the party's report, especially on the staff, customer and public relations policy, that he himself, accompanied by Mr. Ray, went out for a week in January. During the visit Mr. Marples was received by President Eisenhower.

Radiotelephone Services of Cable and Wireless Limited

James H. Wilson

THE DIAGRAM ON PAGE 89 SETS OUT THE main radiotelephone services operated by Cable and Wireless Limited, with the black dots indicating the Company's stations.

This widespread system includes a number of groups of somewhat localized networks and comprises over 100 separate radio links operated from 39 different stations. In co-operation with local telephone administrations and private telephone companies these links provide radiotelephone communication facilities for many countries, and by interconnexion through the Post Office system in London enable conversations to be set up with most parts of the world.

West Indies and Bermuda

It will be observed that, centred on Barbados, is a network covering all the main islands of the new West Indies Federation, with Bermuda and the mainland colonies of British Guiana (Georgetown) and British Honduras (Belize).

The birth of this system goes back to 1931 when the Company's first radiotelephone service was opened between Bermuda and New York; this modest beginning was to cater for the tourist trade and still does so, though now the service operates several channels and continues to expand.

In many of the smaller islands there is no local telephone network to which radiotelephone calls can be connected, and callers often have to travel to the capital town to take their calls at the booth in the Company's office.

All these places are interconnected with each other and, through the Barbados relay station, are connected to Europe via the Barbados–London link. Barbados is therefore a very important station in the Company's system and in fact operates 14 separate radiotelephone circuits with distant points. Through the transatlantic telephone cable, however, an alternative route to Europe can be obtained from certain points via the United States of America.

The Far East

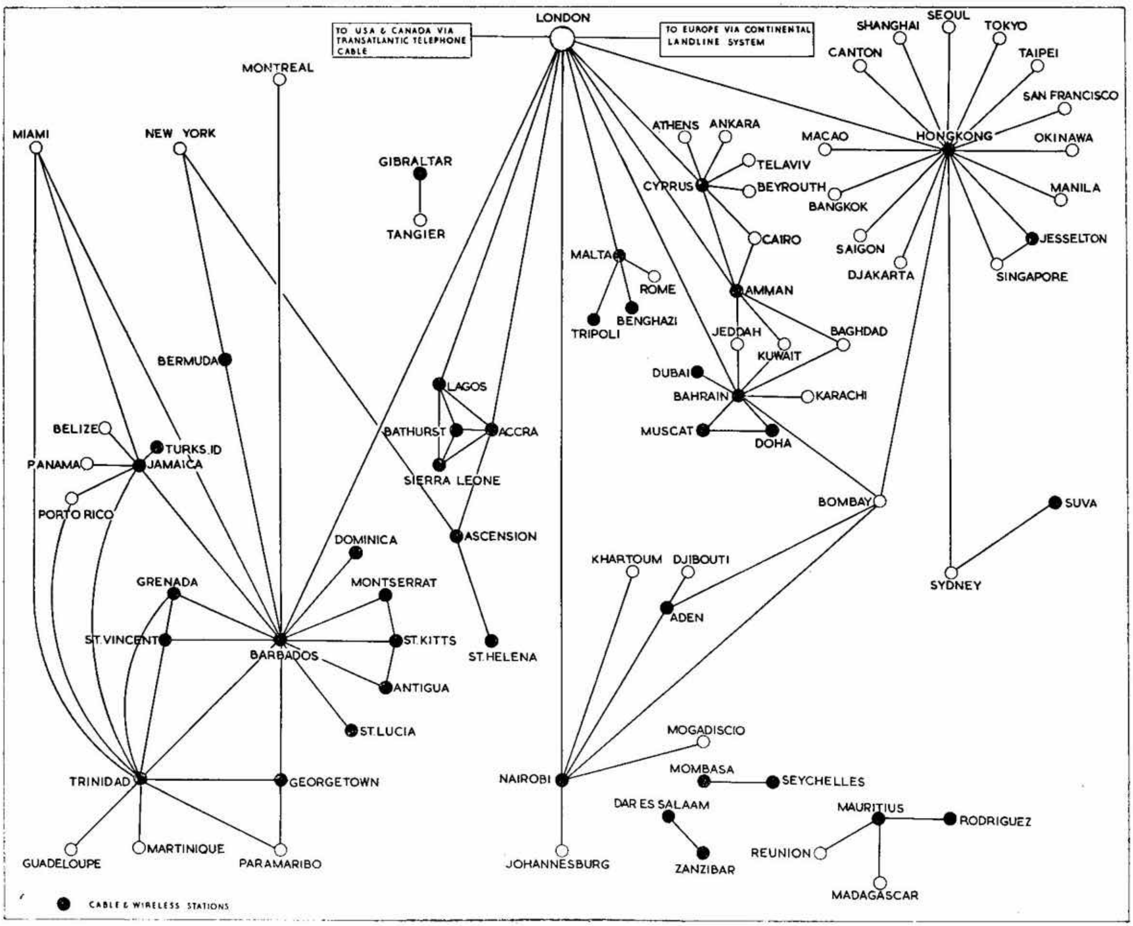
Hong Kong, which operates services to most other important countries in that part of the world is of equal significance as a major radiotelephone station. Actually, Hong Kong carries 50 per cent. of the total radiotelephone traffic handled by the Company's stations, although a large part of this is made up of traffic with mainland China carried on a multi-channel VHF link to Canton. During the war the station was in the hands of the Japanese and was virtually destroyed.

Of some interest from the radiotelephone point of view is the perhaps unique service available to ships at Hong Kong, which can hire VHF radio sets from the Company while they are in harbour, to enable them to obtain connexion through the Company's VHF exchange with the local telephone system operated by the Hong Kong Telephone Company.

West Africa

Another area network covers West Africa, with stations at Lagos (Nigeria), Accra (Ghana), Freetown (Sierra Leone) and Bathurst (Gambia). The switching station in this area is Accra, which can interconnect all the others and has a link to London; but Lagos also has its own direct radio link with the United Kingdom and is building up quite a heavy volume of traffic.

The Nigerian Administration (as shown in the article on page 66) is installing an extensive internal VHF system and it is gradually becoming possible to connect many of the distant areas of this vast territory to the international system. Accra is also a relay station for the islands of St. Helena and Ascension far out in the South Atlantic Ocean. Ascension was for many years peopled only by the



Schematic diagram of the system

employees of the Company, and before radiotelephony was introduced their only contacts with the world were the submarine telegraph cable and infrequent mail steamers.

East Africa

The whole of East Africa is connected to London by the radio station at Nairobi. Tests are now being made to extend service to Zanzibar—the spice islands which provide the world with cloves; Zanzibar already has a VHF link with East Africa via Dar-es-Salaam.

The Company also plans to link the island of Mauritius, in the Indian Ocean, to Nairobi and thence to the rest of the world via London.

Aden, at the eastern end of the Red Sea, has a link to the United Kingdom via Nairobi, but is itself a station where radio services are being considerably expanded and service to various other countries in the area is planned.

Persian Gulf

In the Persian Gulf the Company operates at a number of points, with a main relay station at Bahrain, and is also responsible for certain local telephone systems. This is an oil producing area of considerable importance, and its continual development makes increasing demands for new services. The intense summer heat in the Persian Gulf is trying to European staff but the Company engages many employees locally (a policy which is being adopted throughout the system) and a London

Operators on duty when the Grenada (B.W.I.) new automatic system was opened in December, 1957

telephone operator or technician may therefore speak on the circuits to Cable and Wireless staff of many different nationalities.

Middle East

A station of some interest is Amman, Jordan, which has been built up from a mobile assembly mounted on lorries, such as the Company has sometimes put into the field in the world's trouble areas when emergency radio communications have had to be set up. A similar assembly, capable of telephony (and which carried programme transmissions from Korea to the B.B.C.), was operated during the Korean war.

Amman carries a considerable number of services linking the Jordan Administration's telephone system with neighbouring Middle East countries, and provides service through London with Europe and America. The station is well known to B.B.C. correspondents, for one of the lorries provides simple studio facilities enabling them to pass the news commentaries which form part of such features as "Radio Newsreel" and which have become a familiar item during recent critical events in this area.

The Cable and Wireless Limited international radiotelephone system has largely developed over the last ten years, and the process continues. New circuits are continually being added and every year sees further isolated communities brought into telephone contact with the rest of the world.

We now stand at the threshold of a new era in international telephony in which the demand, stimulated by public experience of new facilities such as the transatlantic submarine telephone cable, will have to be met partly by additional modern telephone cables and partly by radio links of increased capacity. Modern channelling techniques will help radio to expand and we can foresee a fruitful future partnership of radio and cable in the field of telephony; a similar partnership has long existed in the field of telegraphy.

Post Office Links for new ITA Transmitter

The new Independent Television Authority transmitter at Burnhope, Durham, opened in January uses several links provided by the Post Office.

The station is joined by a single-way link to the Newcastle Studios of Tyne-Tees Television. At first programmes from the main ITA Network are being received over a single-way link from Telephone House, Manchester. The routing involves both land line and radio links, radio being used on the section between Carlisle and the Post Office Radio Station at Pontop Pike. Co-axial lines are used between Manchester and Carlisle and between Newcastle and Burnhope.

A new Post Office Network Switching Centre at Telephone House, Newcastle, was set up to handle both network and local programmes.

Some eight miles of additional co-axial cable were laid to provide the land lines and many new sections added to existing ductways.

Later in the year the radio link will provide a both-way service and this, with other new work at Carlisle, will enable programmes originating in Newcastle to be radiated northwards and southwards to cover the whole ITA national network.

Technical Story of Telephone Automation

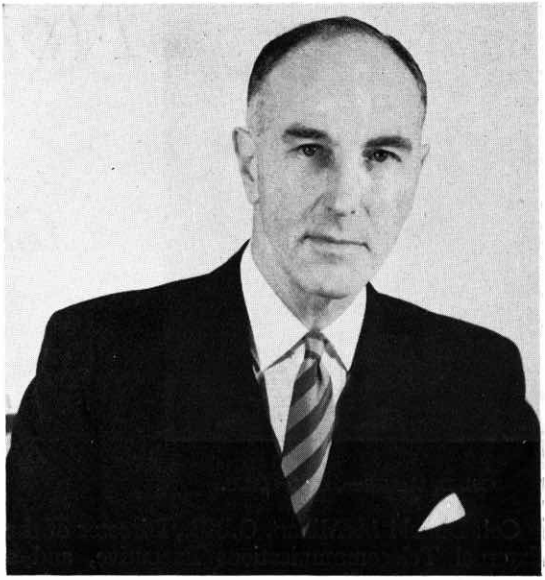
Mr. D. A. Barron, M.Sc., M.I.E.E., Assistant Engineer-in-Chief of the Post Office and at one time a member of the *Journal* Editorial Board, read a paper on STD, telling the technical story of the scheme for full automation of the telephone service, to the Institution of Electrical Engineers on January 22. Sir Gordon Radley, Director General of the Post Office, opened the discussion.

Provincial Centres

Mr. Barron read the paper at Birmingham on January 26 and at Newcastle-upon-Tyne on February 2.

Arrangements have been made so far for him to read his paper at five other I.E.E. provincial centres: Manchester, March 3; Reading, March 16; Nottingham, April 7; Sheffield, April 15; and Stone, Staffs., April 16.

The Assistant Postmaster General opened an extension to Ongar, Essex, Radio Station on February 19. An article on the subject will appear in our next issue.



Mr. C. O. Horn, O.B.E.

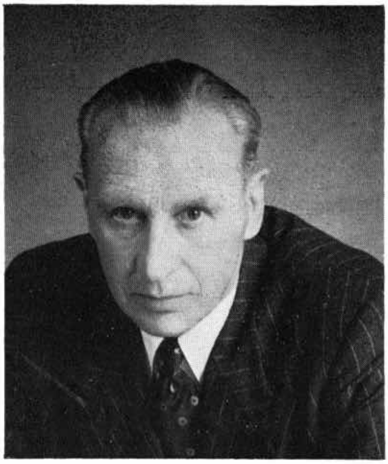
Mr. C. O. Horn, O.B.E., who has been a member of the *Journal's* Editorial Board since September, 1950, leaves the post of Deputy Director of London Telecommunications Region on April 1 to become Director of the Post Office in Wales and Border Counties. He succeeds Mr. F. E. A. Manning, Director since 1950, who is retiring.

An engineer by training, Mr. Horn ended his four years' training at Portsmouth Dockyard School as a Whitworth Exhibitioner, and later studied at the City and Guilds College, London University, where he obtained his B.Sc. in engineering. After a period at Rugby Radio Station he became, in 1936, one of the first 12 Telephone Managers, serving at Leeds. In 1939 he became Telecommunications Controller, Scotland, and subsequently in Home Counties Region, and ten years later Deputy Director, L.T.R.

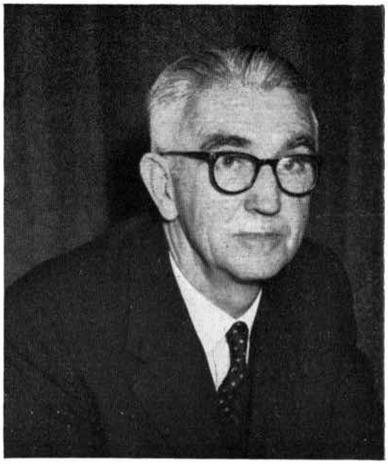
Mr. Horn, who regrettably will be leaving the Editorial Board, has been one of the most active and helpful members, and his enthusiasm and wide experience have been invaluable in assisting the *Journal* to reach its present authoritative position. Among his personal contributions have been *Telephone Exchanges: Before the Building Starts* (November, 1954), and *Exchange Planning in London* (Winter, 1956).

Mr. H. R. Jones (see page 92) becomes deputy to Mr. Horn.

Notes and News



Col. D. McMillan, C.B., O.B.E.



(Courtesy, Western Mail and Echo)

Mr. H. R. Jones, O.B.E.

Col. Donald McMillan, O.B.E., Director of the External Telecommunications Executive, and a member of the *Journal's* Editorial Board since February, 1955, headed, with the C.B., the Post Office people in the New Year Honours List.

Another Board member (since September, 1954), Mr. H. R. Jones, Telecommunications Controller, Wales and Border Counties, was honoured with the O.B.E.

Among other Post Office telecommunications staff were: Mr. T. P. Pitloh, Executive Engineer, Newcastle upon Tyne, Mr. R. W. F. Thorne, lately Overseas Telegraph Superintendent, Central Telegraph Office and Mr. D. C. Walker, Senior Executive Engineer, Research Station, each receiving the O.B.E.

The M.B.E. list included Miss J. L. Aplin, Supervisor, Whitehaven; Mr. R. W. M. Burns, D.C.M., Technician Class I, Lancaster; Miss M. I. Byrne, Chief Supervisor, Coventry; Miss L. M. Clifford, Travelling Supervisor, Reading; Mr. F. J. Fisk, Technical Officer, East Area, London Telecommunications Region; Miss M. Mackenzie, Assistant Supervisor, Oban; Miss M. N. Rookley, Supervisor, St. Austell; Miss H. M. Trenerry, Chief Supervisor, Long Distance Area, London Telecommunications Region and Mr. A. J. Welberry, Technical Officer, Leafield Radio Station.

*   *   *

Post Office facilities available for use with computers are described in both general and technical terms in a new booklet, *Facilities for Data Transmission*. The Post Office offers to advise on the technical requirements which must be taken into account in designing equipment for transmitting data over Post Office lines. The booklet deals specifically with facilities for digital data transmission, but much of the information is applicable to other purposes such as analogue data transmission.

Emphasis is laid on sufficient standardisation of equipment to secure reliability and economy in the use of transmission links.

An article on *Electronic Computers in the Office* appeared in the Spring 1958 *Journal*.

*   *   *

Messrs. D. P. Wratten, Principal, Postal Mechanisation Branch, and L. F. Rutterford, Senior Executive Engineer of a group responsible for the maintenance of telegraph equipment, have been seconded to Unilever for a year under a scheme of interchange of staff between the Post Office and outside industry, with a view to a better understanding of each other's problems.

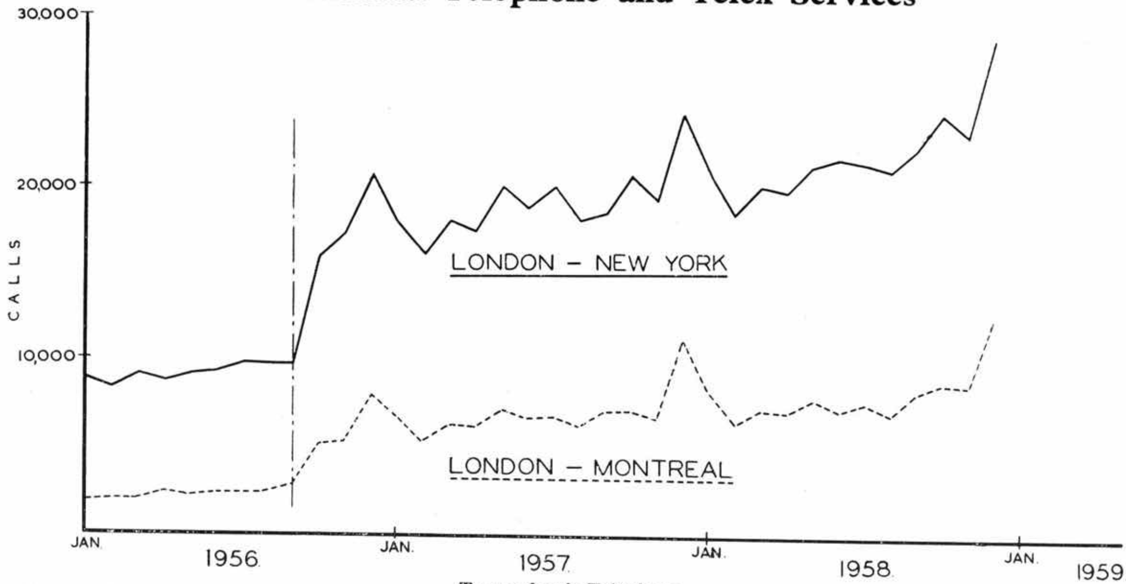
From Unilever, Messrs. R. W. N. Green and E. C. R. Williams have come to the Post Office for a year. The interchange began in January.

Plans are being discussed for interchange with another large business organisation.

*   *   *

A new telephone at the William the Conqueror, Ilford, Essex, is ILF 1066.

International Telephone and Telex Services



Transatlantic Telephone

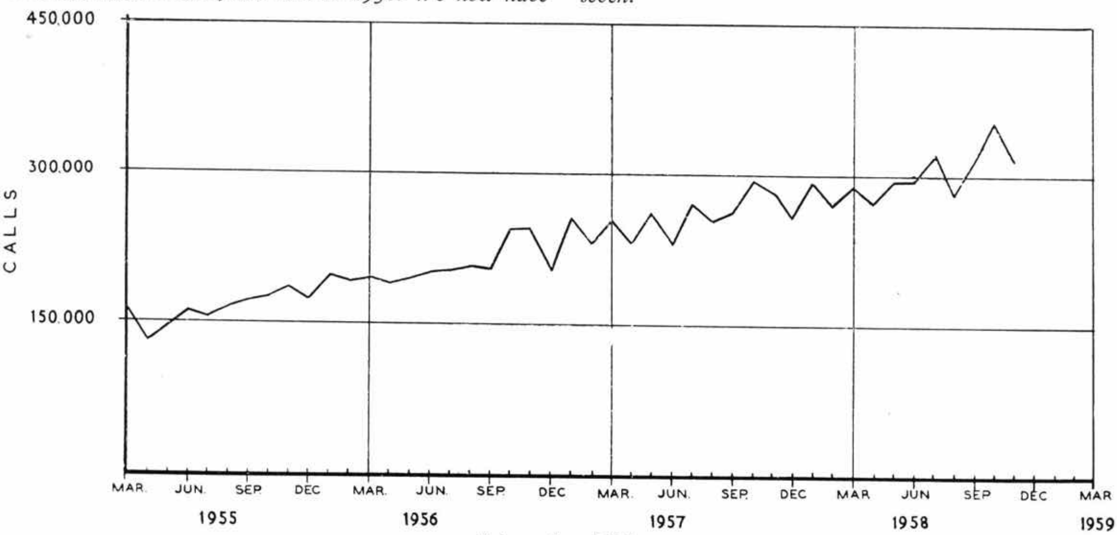
The graph above shows the phenomenal growth in transatlantic telephone calls since the telephone cable was opened. Peaks show that more and more people are using the service for Christmas greetings.

Other extra-European countries are served by radio; about 135,000 *calls were made in* 1958 *and growth continues at about* 9 *per cent. a year.*

About $4\frac{1}{2}$ *million calls were made last year to and from European subscribers, continuing the steady increase of about* 7 *per cent. a year. A new cable to Ostend, giving* 120 *additional circuits, was laid in* 1958. *We now have* 666 *cross-Channel circuits in* 20 *cables.*

Any telex subscriber in the United Kingdom can use the international telex service for calls to 36 *countries,* 15 *of which are outside Europe. New services have been opened with* 19 *countries since* 1954. *The graph shows that since* 1954 *the number of calls has doubled; it now exceeds* 300,000 *a month and revenue is running about* £1,100,000 *a year.*

The duration of calls to the Continent averages about four paid minutes; to the rest of the world, about seven.



International Telex

OUR CONTRIBUTORS

F. C. CARTER ("The New Telephone") is the Staff Engineer of the Subscribers' Apparatus and Miscellaneous Services Branch of the Engineering Department. He entered the Post Office in 1925 as a Probationary Engineer and for some years was attached to the Radio Branch where he was engaged in the development of short wave transmitters and antennae systems. In 1932 he transferred to the Design Section of the Engineer-in-Chief's Office and became interested in the design of line transmission equipment and telegraph apparatus. In 1937, when this Branch became the Subscribers' Apparatus and Miscellaneous Services Branch, he became interested as an Executive Engineer in the development of subscribers' apparatus and services and after promotion to Assistant Staff Engineer in that Branch in 1939 became Staff Engineer in 1946.

In 1955 he visited the U.S.A. for the Post Office to study developments in subscribers' services.

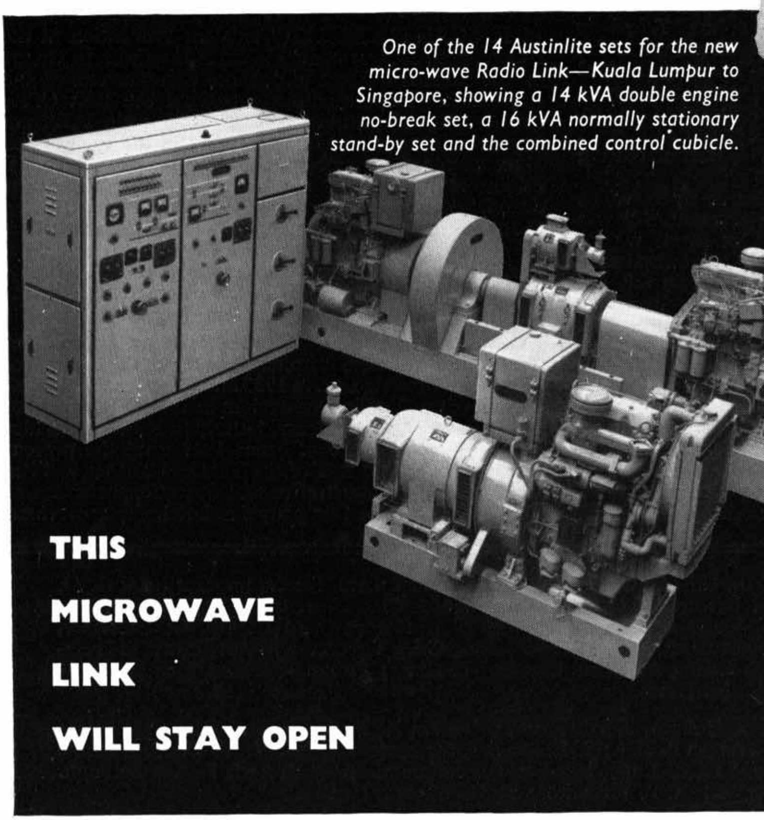
R. W. CHANDLER (' National Telephone Numbers") is a Chief Telecommunications Superintendent in the Telephone Mechanization Branch of the Inland Telecommunications Department. He entered the Post Office in 1927 as a Probationary Inspector in the Engineering Department, but in 1929 moved to the Traffic side of the London Telephone Service. At the outbreak of war he was appointed Communications Adviser to the London Fire Service, later joining the communications staff of the London Civil Defence Region. In 1948 he came to Headquarters for the first time, joining the Central Organisation and Methods Branch for a five year tour of duty on O & M assignments, including the introduction of mechanical trunk fee accounting at Canterbury and reviews of Regional Finance Branches. In 1953 he was posted to the London Telecommunications Region for a few months' experience as Chief Telecommunications Superintendent in the North West Area, eventually returning to the Planning Branch of the ITD, where he remained until the formation of the Telephone Mechanization Branch. He was a member of the STD Study Group from 1953.

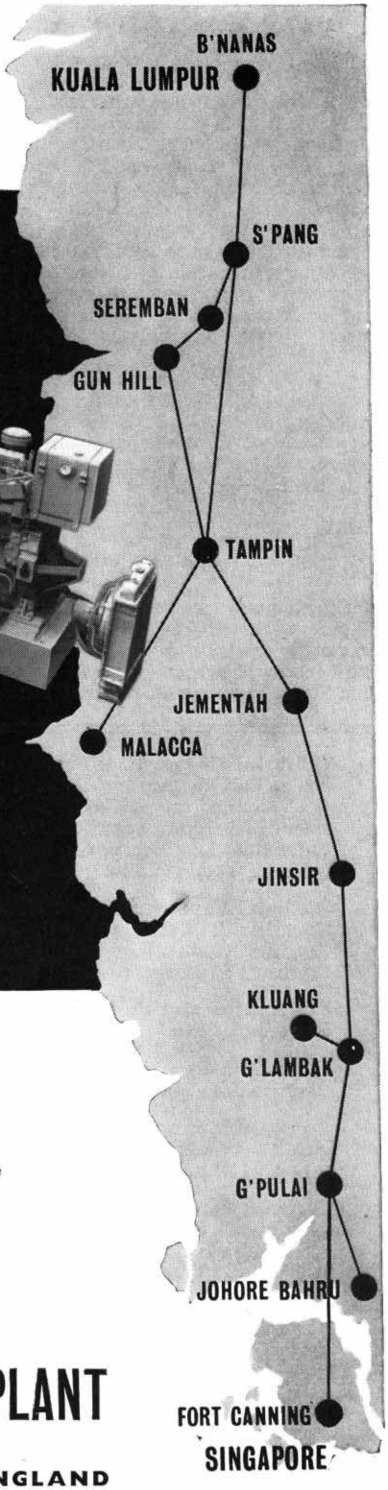
H. P. PALMER ("The New Science of Radio Astronomy") is a lecturer in physics at the University of Manchester. After graduating in physics, he worked on meteorological problems at the Clarendon Laboratory, Oxford, under Professor G. M. B. Dobson. He moved to Jodrell Bank in 1952, where he has been concerned with the development and use of radio interferometers with very long base lines.

W. G. G. ROLLASON ("Developing Services in Nigeria and the Southern Cameroons") has been Controller of Telecommunications in Nigeria since March, 1956. He served in the Engineering Department of the Post Office from 1930 to 1937 and was an Assistant Traffic Superintendent from 1937 to 1946. In 1946 he was seconded to

(*continued on page 96*)

Whatever happens to the mains supply...





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Mr. J. ATKINSON

We regret to announce that Mr. J. Atkinson, Assistant Staff Engineer-in-Charge of the Post Office Engineering Department Exchange Planning Section, and for the past year the Department's representative for the *Journal*, died suddenly on January 17.

Mr. Atkinson was author of the two-volume *Telephony* published in 1949, which became a standard work. He joined the Post Office as a Youth-in-Training in 1928 becoming a probationary Inspector in 1931, an Assistant Engineer in 1935, Area Engineer, Edinburgh, in 1940, and an Assistant Staff Engineer in 1954. For a year, 1950 to 1951 he was with the Telephone Manufacturing Co., Ltd.

"J. A." took an enthusiastic interest in many activities, being a photographer of no mean achievement. He was lively in company and kindly in all his deeds, with a very wide circle of friends. He was an outstanding Telephone Engineer and his loss will be deeply felt not only by his colleagues at Headquarters but by many others in all branches of the telecommunications industry.

Telephone service between the United Kingdom and all parts of the Soviet Union was opened on January 19; previously service had been limited to Kiev, Leningrad and Moscow. Charges are based on three-minute calls. The Soviet Union is divided into four charge zones.

Our Contributors

(*continued from page 94*)

the Foreign Office German Section in Berlin and from 1950 to 1956 he was Assistant Controller Telephone Services in the Sudan. He became Assistant Controller in Nigeria on January 1, 1956.

L. F. SCANTLEBURY ("Accident Prevention in the Engineering Department") is Staff Engineer in charge of the External Plant and Protection Branch of the Engineering Department. He entered the Post Office Engineering Department as an old style Assistant Engineer in 1930 and after training in the then South West District was appointed to Bournemouth Sectional Engineers' Office on construction and maintenance duties. Transferred on promotion to the Scottish Region in 1937 as Efficiency Engineer, he acted as Liaison Officer on communications to Scottish Command during the war. In 1943 he came to London to re-start the Organisation and Efficiency Branch of the Engineering Department and transferred to his present duties in 1951.

JAMES H. WILSON ("Radiotelephone Services of Cables and Wireless Limited") entered the service of Cable and Wireless Ltd. in 1933 and joined the Statistical Section of the Traffic Department in 1937. From 1939 to 1946 he served in the Army, latterly in R.E.M.E. Radar and Wireless workshops. From 1947 until the present he has been on the staff of the Traffic Manager and has specialised in administrative and operational matters in connexion with the Company's radiotelephone services.

Publication and Price. The *Journal* is published in November, February, May and August, price 1/6. The annual postal subscription rate is 6/6 to any address at home or overseas.

Contributions. The Editorial Board will be glad to consider articles of general interest within the telecommunication field. No guarantee of publication can be given. The ideal length of such articles would be 750, 1,500 or 2,000 words. The views of contributors are not necessarily those of the Board or of the Department.

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GPO

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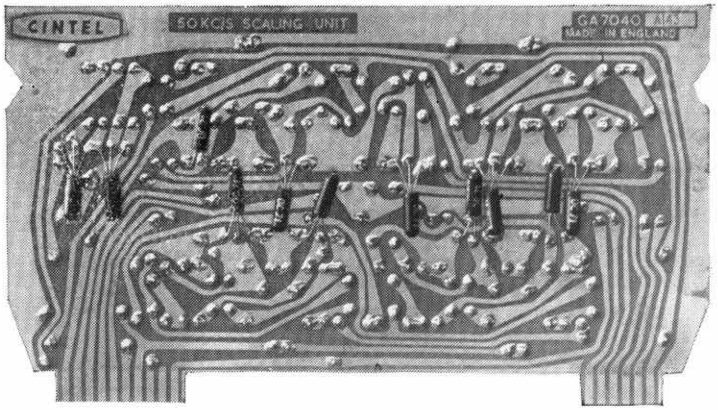

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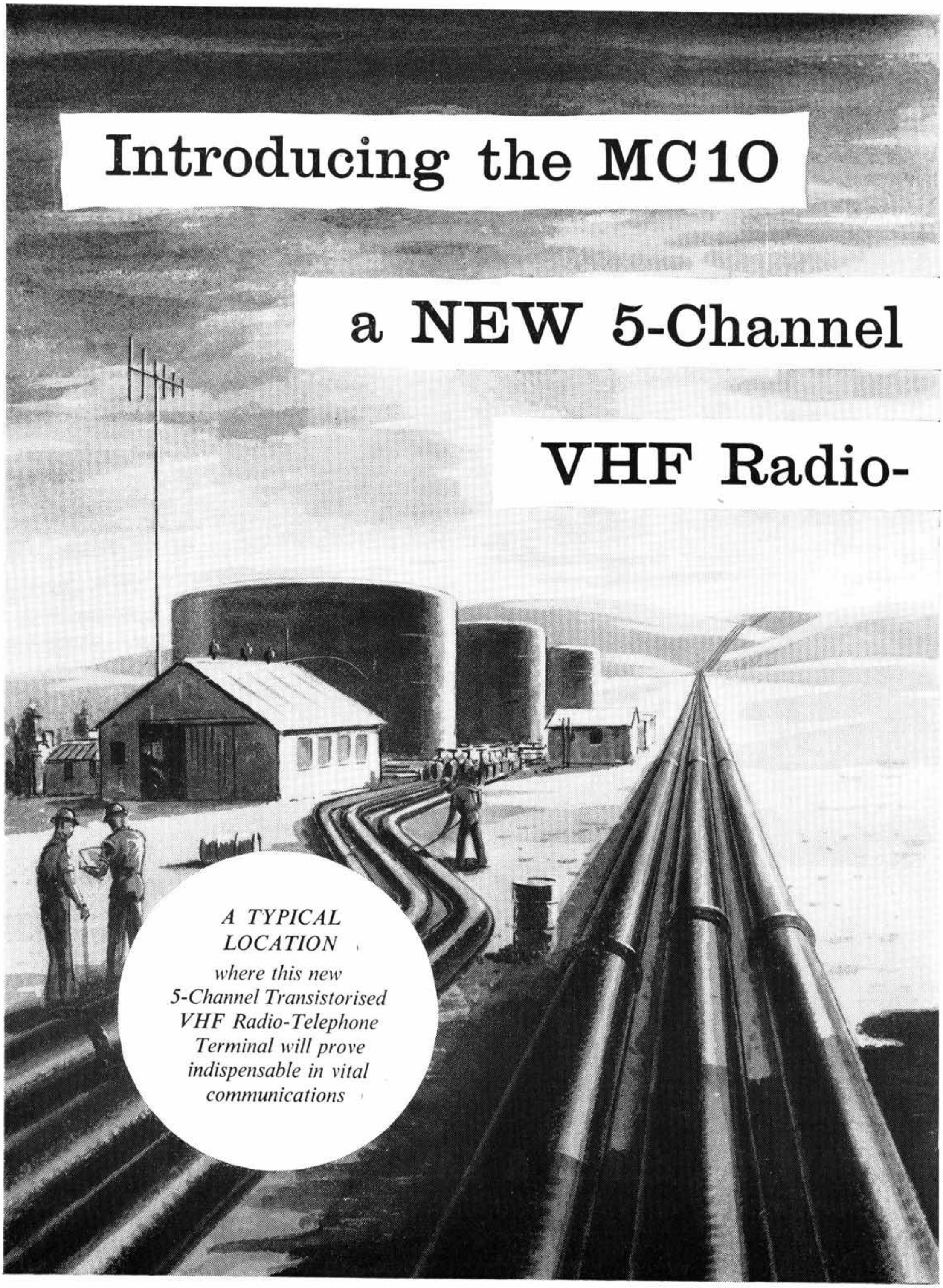
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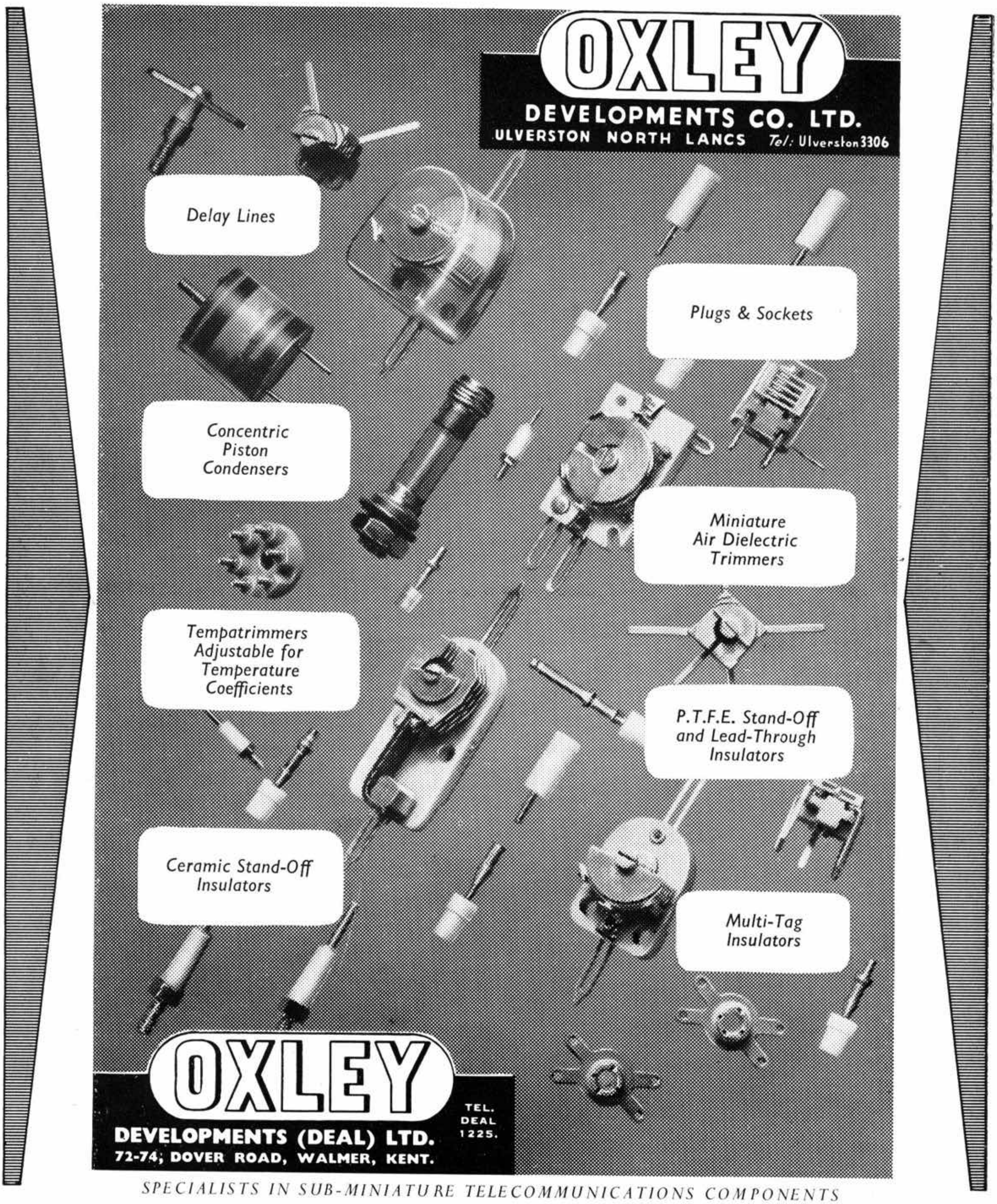

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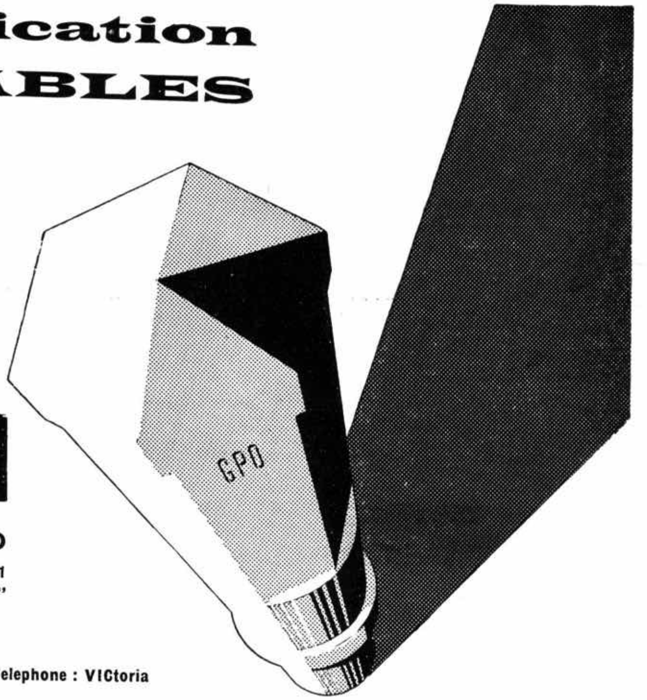
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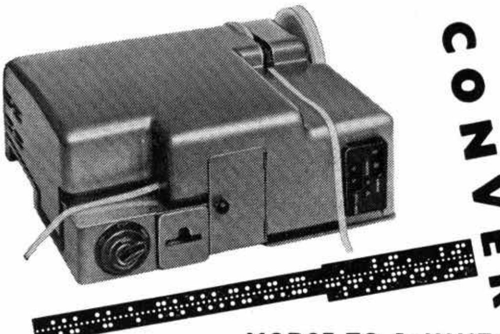

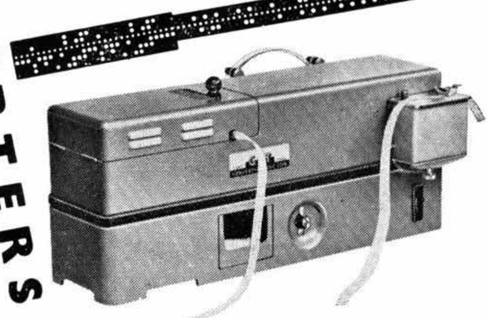

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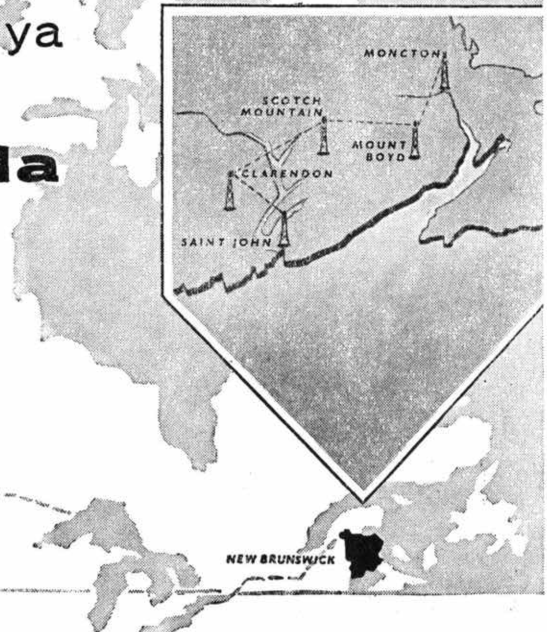

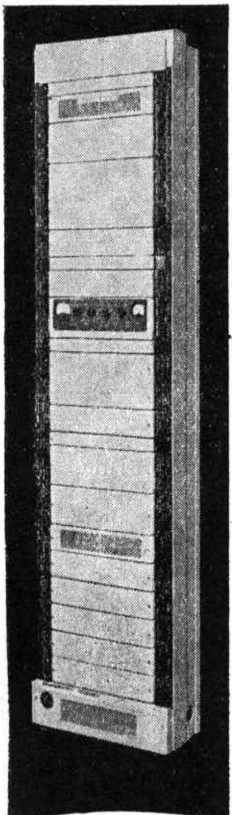

240 circuit terminal rack

The General Electric Co. Ltd. of England has received a contract from The Canadian General Electric Co. Ltd. to supply a multi-circuit microwave radio system between Saint John and Moncton, for The New Brunswick Telephone Company, Limited. G.E.C. 240-circuit 2000 Mc/s radio equipment will be employed, equipped initially for 60 speech circuits. The equipment will convey television signals instead of telephony circuits, if required.
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